

MOSS FLORA

OF

NORTH AMERICA

North of Mexico

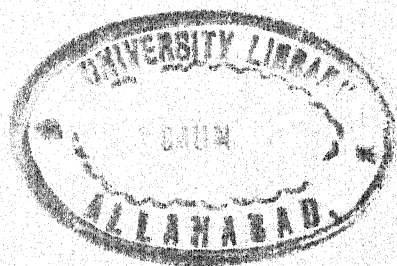
BY

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Family HYPNACEAE

Plants creeping in habit, forming mats of more or less closely interwoven stems and branches, growing mainly on soil and rotten wood, less frequently but commonly on stones and trunks of trees, a few aquatic.

Leaves costate or ecostate, not papillose, except *Bryhnia*, *Isoetecium*, and *Hylocomium* species. Capsules on elongated setae more or less curved and unsymmetric except in the *Climaciæ*, *Entodontæ* and a few anomalous mosses. Peristome usually perfect, the cilia often lacking in mosses with erect capsules, segments always keeled; teeth strongly articulate, marked at base between the articulations by characteristic fine transverse lines except in a few forms with erect capsules and degenerate peristomes. A very large family closely related to the *Leskeaceæ*, from which it differs in the non-papillose leaves and also usually in the longer leaf cells and unsymmetric cernuous capsules. The peristomes are very close to those of the *Bryaceæ* except for the fine transverse lines on the peristome teeth.

This family is a large and somewhat heterogeneous one and includes practically all the pleurocarpous mosses with elongated smooth leaf cells and well-developed peristomes, *i. e.*, having broad keeled segments and, usually, well-developed cilia. Although the leaf cells are often short and broad, they are more or less rhomboidal or elongated-hexagonal in outline and in the middle of the leaf are never regularly oval, rounded, or quadrate.

The mosses of this family may be found in all kinds of habitats, and some individual species have a wide range of habitat.

The classification of this family is a matter upon which no two bryologists would be likely to agree. No single character can be relied upon as a basis of classification, and it is extremely difficult to select combinations of characters that will indicate relationships with any degree of accuracy. Many characters relied upon in the past are almost certainly very highly modified, if not actually produced, by habitat conditions. Short thick-walled leaf cells are so frequently correlated with a xerophytic habitat as to suggest a causal relation. There is almost certainly a relation between habitat and the curvature and direction assumed by the capsule, and between this last and the completeness of the peristome. These statements, of course, apply to mosses outside this family, but the difficulties in classification caused by these facts are particularly prominent here.

The following grouping into subfamilies is primarily based more on the structure and robustness of the costa and the presence or absence of central strand in the stems than most of the older groupings. For exceptions to the characters indicated in this key see the descriptions of the subfamilies.

KEY TO SUBFAMILIES OF THE HYPNACEAE.

- | | |
|--|---|
| 1. Costa strong and extending to the middle of the leaf or beyond, nearly always single (exceptions in <i>Hylocomium</i> and <i>Campylium</i>)..... | 3. |
| Costa short and double or lacking..... | 2. |
| 2. Capsules erect and symmetrical, or nearly so; cilia of inner peristome rudimentary or lacking..... | <i>Entodontæ.</i>
<i>Hypnææ</i> &
<i>Sematophylleæ.</i> |
| Capsules unsymmetric, more or less curved, usually cernuous..... | |

3. Plants large, secondary stems stout and dendroid from creeping or stoloniferous primary stems. 4.
Plants smaller, scarcely dendroid. 5.
4. Capsules erect and symmetric (exc. *Girgensohnia*); peristome without cilia. *Climaciez.*
Capsules curved, cernuous; peristome perfect. *Porotrichez.*
5. Capsules ovoid, short, thick and unsymmetric, usually little contracted under the mouth when dry; stem and branch leaves often quite different. 6.
Capsules longer, arcuate-cylindric as a rule, usually more contracted under the mouth when dry. *Amblystegiez.*
6. Costa single and usually reaching well beyond middle of leaf; seta often rough; paraphyllia lacking. *Brachytheciez.*
Costa frequently double, often short; paraphyllia large and abundant in many species; seta smooth. *Hylacomiez.*

Subfamily CLIMACIEAE

Characterized in general by the dendroid habit from a creeping, strongly radiculose primary stem (except forms of *Climacium Kindbergii*) having a well-marked central strand, strongly costate leaves, secondary stems and branches bearing numerous filiform paraphyllia, erect symmetric capsules and well-developed peristome, with cilia rudimentary or lacking, as are the fine transverse lines on the base of the peristome teeth (except *Girgensohnia*). The relationships of the genera included in this subfamily are problematical and it is doubtful if *Climacium* and *Girgensohnia* belong in the same subfamily, but superficial appearances, at least, will cause them to be associated with each other and the *Porotricheae*.

KEY.

- Capsules erect, symmetric; leaves scarcely decurrent. *Climacium.*
Capsules curved and cernuous; leaves long-decurrent with hyaline inflated cells. *Girgensohnia.*

CLIMACIUM Web. & Mohr, Iter Suec. 96. 1804. (Reise durch einem Theil Schwedens).

Large handsome mosses with a tree-like habit of growth from underground creeping stems (p. 300 and 301 M.H.M.*). Sometimes prostrate, or floating in very wet places. Stem and branches bearing paraphyllia. The leaves vary greatly in shape and structure. Those figured are from the middle of well-developed branches. The leaves of the main upright stems are very large, thin, with little chlorophyll, closely imbricated and clasping. Branch leaves smaller, of a different shape and texture, chlorophyllose. All our species are dioicous. The seta is long and smooth, twisted to the right when dry. Calyptra split on one side, long, reaching to the base of the capsule. Capsule erect, cylindric; operculum conic-rostrate with the beak often oblique; annulus none; peristome double; teeth linear-lanceolate, very long, closely articulate, minutely papillose; segments as long as the teeth, keeled, split between the articulations, often split to the apex when old, united at the base into a continuous narrow basal membrane, minutely papillose; cilia lacking or rudimentary. Type species *C. dendroides*.

Mosses of swampy woods and fields; fruiting with comparative infrequency. The systematic position of this genus is as yet doubtful. It certainly does not belong in the *Entodontae*, where it has previously been placed. The lack of transverse lines on the peristome teeth indicates that it is either not a member of the family Hypnaceae or else is a very highly modified member. It has been placed near the *Fontinalaceae* but I have changed my opinion as to this relationship and can see little evidence to support such an arrangement.

KEY.

1. Capsules 3 to 4 times as long as broad; median leaf cells 7-10-times as long as broad. *dendroides*.
Capsules 5-6: 1; median leaf cells not more than 7: 1. 2.
2. Plants of a distinctly tree-like habit; median leaf cells 5-7: 1. *americanum*.
Plants growing in dense tufts so that the tree-like habit is obscured, or prostrate and hypnoid in appearance; median leaf cells 2-3: 1. *Kindbergii*.

* M.H.M. = Mosses With Hand-lens and Microscope.

CLIMACIUM DENDROIDES (L.) Web. & Mohr, Iter. Suec. 96. 1804.

Hyponum dendroides L. Sp. Pl. 118. 1753.

Plants dark to bright green, 7-9 cm. tall; branches suberect to spreading; branch leaves loosely imbricate, about 2×0.7 mm., upper oblong-lanceolate; lower ovate-lanceolate to oblong-lingulate, obtuse, denticulate at base, sharply serrate above, bisulcate, costate nearly to apex; basal angles sometimes slightly enlarged; median cells linear-rhomboidal to linear-hexagonal, 7-10:1; alar and apical cells much shorter and broader; stem leaves larger, 2-3 mm. long, ovate, entire, apiculate. Perichaetial leaves about 5 mm. long; inner oblong to oblong-ovate, slightly serrate at apex, long-acuminate, thinly costate, costa often short or wanting; leaf cells linear above, rhomboidal and brownish yellow below. Seta reddish brown, 2.5-3.5 cm. long; capsule lighter in color, cylindric, about 4 mm. long, 3-4:1; operculum often remaining attached to the columella; spores 13-22 μ . Fruit rather infrequent and sparingly produced, maturing in autumn.

Type locality: European, probably Swedish.

Wet ground, especially borders of streams, swamps and lakes, frequent, ranging through the northern and western part of the continent from New Brunswick to St. Paul Island, Behring Sea; south to New Jersey, Colorado, New Mexico and California. Not reported from the North Central states.

ILLUSTRATIONS.—Br. & Sch. Bryol. Eur. *pl.* 437 and in many other works.

EXSICCATI.—Drumm. Musc. Am. 230; Austin, Musc. Appal. 286; R. & C. Musc. Am. Sept. Exsic. 237; Macoun, Can. Musc. 264; Grout, N. Am. Musc. Pl. 157, 329, and 440 (as *C. americanum*); Musci Perfecti 139.

VAR. OREGONENSE R. & C. Bot. Gaz. 15: 59. 1890. "Differs from the type in the leaves narrowed at base, less serrulate at apex, sometimes subentire." Oregon, Willamette R. (L. F. Henderson).

A form from Sauvie Island, Oregon, has almost entire leaves that are broader than usual instead of narrower. (C. G. Pringle, no. 510.)

Number 12346, of Fernald and Long from "shaded rock pockets and crevices covered at high tide in the valley of the Cathance R., Sagadahoc Co., Maine," consists of floating stems only, with spreading leaves that are intermediate between stem and branch leaves. A very interesting form and difficult to place.

CLIMACIUM AMERICANUM Brid. Musc. Recent. Suppl. part 2: 45. 1812.

Neckera dendroides americana C. Muell. Syn. 2: 122. 1852.

Plants 5-7 cm. high; branches usually straight and tapering; branch leaves closely imbricate, 2×1 mm.; upper oblong-lanceolate, *broadly auriculate*; lower ovate to ovate-lanceolate, denticulate below, sharply serrate above, more acute than in the last, bisulcate, costate nearly to the apex; leaf cells more nearly uniform than in *C. dendroides*; median cells oblong-hexagonal, 5-7:1; stem leaves as in *C. dendroides*; perichaetial leaves oblong-ovate, 4-5 mm. long, much like those of the preceding. Capsule cylindric, about 6 mm. long, 5-6:1; peristome teeth sometimes slightly perforated; spores maturing in autumn. Distinguished from *C. dendroides* by its more closely imbricated leaves, broadly auriculate branch leaves, longer capsules and shorter leaf cells.

Type locality: Lancaster, Pennsylvania.

Swamps, wet soil, rotten logs, etc.

This species is exclusively American. It is found in the northern and eastern states, ranging from Canada to North Carolina and probably south to the Gulf; west nearly or quite to the Rocky Mts.

ILLUSTRATIONS.—Sull. Mosses of the U. S. *pl.* 5 & Icon. Musc. *pl.* 97.

EXSICCATI.—Drumm. Musc. Am. 231; Sull. & Lesq. Musc. Bor. Am. Ed. 1, 271, Ed. 2, 402; Austin, Musc. Appal. 287; Macoun, Can. Musc. 265; Grout, N. Am. Musc. Pl. 165.

CLIMACIUM KINDBERGII (R. & C.) Grout, Bryologist 4: 54. July, 1901.

Climacium americanum Kindbergii R. & C. Bot. Gaz. 15: 59. 1890.

Plants dark green, almost black, below rarely lighter green, growing typically in dense tufts or cushions in very wet swamps, somewhat tree-like in habit, but growing so compactly together as to obscure the dendroid appearance. On the edges of pools and on sticks and stones in pools the stems are decumbent, irregularly branching, often floating, dendroid secondary stems rarely present.

Stem leaves scattering, ovate; branch leaves ovate-lanceolate, somewhat auriculate, less differentiated than in *C. americanum*, clasping by enlarged rounded basal angles, sulcate; areolation nearly uniform;

median cells oblong-hexagonal, 2-3:1. Seta usually much longer and more flexuous than in *C. americanum*; capsule about the same as in that species, 4-6 mm. long; teeth of peristome usually more or less perforate. Spores in autumn. Swamps, having the range of the preceding species, extending to Florida and the Gulf States, where it frequently assumes the dendroid form. When growing out into the water it sometimes has the habit of a *Fontinalis* with distant leaves.

Type locality: Lafayette Woods, Louisiana (Langlois).

EXSICCATI.—Austin, *Musc. Appl.* 288 & 289 as *C. americanum fluitans*; R. & C. *Musc. Am. Sept. Exsic.* 238; Grout, *N. Am. Musc. Pl.* 98. Some specimens at least, of Sull. & Lesq. *Musc. Bor. Am. Ed.* 2, 42 & Drummond's *Musc. Am. (S. States)* 120 are this species.

Although Brotherus in the second edition of Engler & Prantl, *Natürlichen Pflanzenfamilien* does not recognize this species, I am still of the opinion that it is a good species closely related to *C. americanum*, as occasional forms with the short leaf cells and a dendroid habit or auriculate leaves are occasionally met with. The typical form seems most abundant along the coast and in the South; in general this species has the range of *C. americanum*, but is much less frequent inland than that species. Aquatic forms of the other two species may be confused with this. Usually distinguished at a glance by its color and habit of growth; surely determined by the larger, proportionately broader branch leaves without the conspicuous auricles of *C. americanum*, yet more auriculate than *C. dendroides*, and specially by its very short leaf cells.

GIRGENSOHNIA Kindb. Spec. Eur. & N. Am. Bryn. Pt. 1: 43. 1896.

Climacium Sec. B, Girgensohnia Lindb. Act. Soc. Fenn. 10: 248. 1872.

Pleuroziopsis Kindb. Ck. List Eur. & N. Am. Moss. 19. 1894.

(*P. ruthenica* was the third species named in a bare list of four and cannot be taken as the type species.)

Only one species is known. (Plate I.)

GIRGENSOHNIA RUTHENICA (Weinm.) Kindb. l. c.

Hypnum ruthenicum Weinm. Bull. Soc. Imp. Mosc. 18: Pt. 2: 485. 1845.

Plants light green, from creeping stoloniferous primary stems, dendroid, one-sided, suggesting minute *Pteris aquilina*; secondary stems erect, reaching 8 cm. or more in height; branching pinnate to bipinnate; branchlets slender, attenuate, 5-10 mm. long, covered with simple and branched filiform paraphyllia; stem leaves scale-like, clasping, broadly ovate, narrowed to insertion, rounded or apiculate at the obtuse apex, entire, with a thin slender costa extending to middle (Sullivant says "*energia vel valde nervosa*"); leaf cells long and narrowly linear-vermicular, basal cells shorter and broader. Leaves of branches ovate, rather obtuse, entire or serrate at apex, strongly costate to near apex, long-decurrent with hyaline inflated cells; median cells narrowly linear-vermicular; leaves of branchlets loosely imbricate, lanceolate, decurrent as in the branch leaves, bisulcate, strongly serrate above, strongly costate nearly to apex; costa dentate on the back above; median leaf cells linear-vermicular, upper broader and shorter; inner perichaetial leaves closely imbricate, broadly ovate, long cuspidate-acuminate, costate; outer ecostate. Dioicous. Seta short, smooth, calyptra cucullate, covering only $\frac{1}{2}$ the capsule; capsule oblong-cylindric, arcuate, cernuous, operculum long-conic, almost rostrate; annulus lacking; peristome teeth broader than in *Climacium*, hyaline-margined; segments also broader, open between the articulations, more or less papillose, as long as the teeth; cilia lacking; spores 15-20 μ .

Type locality: "In insula Sitka."

Seattle, Vancouver Island, Alaska, Japan.

ILLUSTRATION.—Sull. *Icon. Suppl. pl.* 58; *Pl.* 1.

POROTRICHEAE.

Plants more or less dendroid in habit from creeping stoloniferous stems; stems and branches with central strand; leaves strongly costate; leaf cells short and broad; seta long; capsules somewhat unsymmetric and inclined, with a perfect hypnaceous peristome.

Brotherus in Engler & Prantl puts this group in the Neckeraceae, a disposition with which I cannot agree. Dixon considers that the short areolation reads it out of the Hypnaceae but I would suggest that one consider the areolation in *Climacium dendroides* and in *C. Kindbergii* as illustrating the variations in areolation in so small a group as this very clear-cut genus. To me it seems that the affinities of *Bestia* are with this group rather than with the Crypheaceae.

KEY.

1. Plants large, robust, plainly dendroid when well developed, not complanate foliate... *Porotrichum*.
Plants either not dendroid or much smaller and more delicate, many complanate-foliate..... 2.
2. Plants distinctly complanate-foliate, resembling *Plagiothecium sylvaticum* in aspect... *Porothamnium*.
Plants more slender, less markedly *Plagiothecium*-like, pinnately branching or dwarfed-dendroid..... *Bestia*.

POROTRICHUM Brid. Bryol. Univ. 2: 275. 1827. Thamnum Br. & Sch., Bry. Eur. 1852.

Though Thamnum was used for the name of this genus earlier than Porotrichum, it had previously been used for three other genera of plants according to Dixon, Hdbk. 3d Ed. 408.

Plants dendroid from creeping stoloniferous stems, robust; leaves ovate to oval-oblong, strongly costate, serrate; leaf cells short and broad, thick-walled, basal longer and narrower, alar usually smaller and subquadrate; capsules usually somewhat inclined and arcuate; peristome perfect, cilia appendiculate. Type species *P. longirostre* (Hook.) Mitt.

KEY.

- Middle branch leaves sharply acute; elongated cells usually extending beyond end of the costa itself *allegghaniense*.
Some or all of the middle branch leaves broad and rounded in outline at the apex; costa much narrowed at the end but not continued by elongated leaf cells..... *neckeroides*.

POROTRICHUM ALLEGGHANIENSE (C.M.) Grout, Mosses H.-lens & Mic. 303, April, 1908.

Hypnum allegghaniense C. M. Synopsis 2: 502. 1851.

Thamnum allegghaniense Br. & Sch., Bry. Eur. fasc. 49-51, pl. 4. 1852.

Thamnum pseudoneckeroides Kindb., fide Cardot.

Conspicuously dendroid when well developed, robust; secondary stems 2-3 cm. long, rigid, inclined, naked or covered with small scale-like appressed leaves, very dark green in old or stunted plants, light green when young and vigorous; branches stout; median branch leaves loosely erect-open, 2-3 mm. long, ovate to elliptical-oblong, oblong-lanceolate on the smaller branches, narrowed to the subclasping insertion, *acute*, coarsely and irregularly serrate above, concave; costa stout, somewhat toothed on the back, a single layer of elongated cells often continuing beyond the costa; upper leaf cells near end of costa rhomboid-elliptic to oblong-hexagonal, *about 18 μ long, 2 : 1*; median cells often smaller and quadrate to hexagonal; median basal oblong to oblong-rectangular, 30-45 μ long, 4-6 : 1; those of the basal margin shorter, smaller and subquadrate; inner perichaetial leaves erect, narrowly acuminate, costate. "Monoicous or synoicous." Seta 10-15 mm. long, usually leaning from the vertical; capsule oblong to oblong-ovoid, somewhat cernuous, symmetric to slightly curved; urn 2-2 1/2 mm. long; operculum obliquely conic-rostrate, one-half the length of the urn; calyptra cuculate, small; annulus narrow; peristome perfect; teeth marked at base with the fine transverse lines characteristic of the Hypnaceae, hyaline and spinose-papillate above; segments from a wide basal membrane, as long as the teeth, open between the articulations, minutely papillose-roughened above, as are the two or three appendiculate cilia of an equal length; spores about 9 μ in diameter, maturing in autumn.

Type from near St. Louis, Drummond.

On damp rocks by streams and in cool shaded ravines. Widely distributed but not abundant and rarely developing to full size or fruiting. Northeastern U. S. and eastern Canada, south to Georgia, Alabama, Missouri and Arkansas. Occasionally a form is met with having some of the branches ending in slender leafy flagella.

ILLUSTRATIONS.—Sull. Icon. Musc. pl. 103. M. H. M. 302.

EXSICCATI.—Drumm. Musc. Am. (Coll. II) as *Hyp. neckeroides*; Sull. & Lesq. Musc. Bor. Am. 288, 2nd Ed.; Sull. Musc. Allegh. 9; Austin, Musc. Appl. 337; Macoun, Can. Musc. 302; Grout, N. Am. Musc. Pl. 119.

POROTRICHUM NECKEROIDES (Hook.) Williams, Bull. N. Y. Bot. Garden 2: 137. May, 1901.

Hypnum neckeroides Hook. Musc. Exot. pl. 58. 1818.

Thamnum Leibergii E. G. Britton, Bull. Torr. Bot. Club 16: 111. 1889.

Plants rather coarser than in the last, dark to light green, dendroid when well developed; secondary stems ascending to erect; leaves of secondary stems stiff and rigid, broadly triangular-ovate below, longer and oblong-ovate above, usually broadly acute and faintly serrate at apex; costa very stout and much thickened below; these leaves graduate into the upper stem and lower branch leaves, which are much larger, broadly ovate and rounded or obtusely acute at the serrate apex; middle branch leaves 2–3 mm. long, broadly oblong-ovate, concave, usually round-obtuse at apex, occasionally broadly acute, strongly serrate above; costa stout, extending to near the apex, very strongly dentate on the back above with numerous stout teeth; upper leaf cells near the end of costa irregularly quadrate to hexagonal for the most part, nearly as broad as long, about $15\ \mu$ in diameter; basal cells much as in the last but tending to be shorter and broader. Dioicous. Capsules "oblong-ovate," cernuous; peristome perfect.

In the original plate the segments are shown as widely open between the articulations and the cilia are about $\frac{1}{2}$ the length of the segments above the wide basal membrane. Hooker states that he had not seen the operculum, so that the capsules were not in prime condition and the cilia may have been broken off. Mrs. Britton gives as the only tangible difference between this species and *Thamnum Leibergii* that the cilia in the latter are as long as the segments. I have examined a considerable series of our western *Porotrichum* and can find but one species distinguishable by gametophyte characteristics.

Hooker gives New Zealand as the type locality of the species but Brotherus in the second edition of E. & P. does not credit the species to any region but N. America. As Menzies collected the type it is probable that he got his labels mixed, since he collected on the West Coast also. This seems to be the general opinion, so far as I can determine.

The broad rounded apex of the branch leaves so well shown in the original plate and the smaller isodiametric upper leaf cells distinguish this from the preceding at first sight.

At the ends of the branches and especially on small attenuate branches, the leaves may closely approach those of the last in outline and some of the cells near the end of the costa are markedly longer than broad. I have examined leaves from a branch of the type of *Thamnum Leibergii* and they seem to be more acute with more elongated apical cells than is characteristic of the general run of *P. neckeroides*.

Northwest U. S. and Canada west of the Rockies, seldom fruiting.

ILLUSTRATION.—Hooker, l. c.; Pl. 1.

EXSICCATI.—Allen, Mosses of the Cascade Mts., Oregon, 113; Grout, N. Am. Musc. Pl. Suppl. 19.

Thamnum micro-alopecurum Kindb. Rev. Bryol. 22: 81. 1895. Type from Oregon, Hertzman.

The specimens were sterile. The description is inadequate and might apply to a dozen different mosses. Attempts to get a more definite description or a portion of the type have failed. Considering the well-known quality of Kindberg's work, the species may well be ignored unless the type can be examined by a competent authority.

The report by Macoun of the occurrence of the European *P. alopecurum* in British Columbia is a mistake. This species is dioicous and has branch leaves with the narrowly acute apex of *P. alleghaniense*, with upper leaf cells like those of *P. neckeroides* but even smaller, Limpricht says $7\ \mu$ but I make them nearer $10\ \mu$ in diameter; the leaves are narrower than in either of our species.

POROTHAMNIUM Fleisch. Moosfl. Java 3: 925. March, 1908.

Differing from *Porotrichum* in our forms chiefly by the more compact, less distinctly dendroid growth and complanate leaf arrangement.

We have but one species as *P. neo-mexicanum* Card. of which I have the type collection, should be referred to *Neckera* unless the sporophyte characters, when determined, locate it elsewhere.

POROTHAMNIUM BIGELOVII (Sull.) Fleisch. (fide Broth.).

Hypnum Bigelovii Sull. Pacific R. R. Reports 54: 189. pl. 8. 1856.

Plants bright shining green, subdendroid from a creeping stem, arcuate-ascending, irregularly branching from the upper part of the secondary stems; stems and branches strongly complanate-foliate; leaves spreading, elongated oblong, about 3 mm. long, acute, sharply and coarsely serrate above, costate to near apex, basal margin of lower edge strongly inflexed; upper leaf cells rhomboid, about $30\ \mu$ long, 2–3 : 1; median oblong-linear, $30 \times 8\ \mu$ in the middle of the leaf to linear, $67 \times 9\ \mu$, near base; basal row or two thick-walled, colored; inner perichaetial leaves broadly lanceolate, narrowly long-acuminate, costate, serrate above. Dioicous. Seta 2–2.5 cm. long; capsule oblong-ovoid, cernuous, nearly symmetric; operculum conic-rostrate; annulus of two or three rows of cells; calyptra cucullate; peristome perfect; spores in spring. Type from near San Francisco, Calif.

On moist shaded rocks, sometimes in reach of salt spray.

ILLUSTRATION.—Sull. l. c.; *Pl. 1*.

San Francisco northwards along the coast ranges to Vancouver; Idaho.

EXSICCATI.—Allen, Mosses of the Cascade Mts. 114; Grout, N. Am. Musc. Pl. 82.

The herbarium specimens, at least, of this species, resemble *Plagiothecium* very strongly. The ends of the branches are sometimes flagellate.

BESTIA Broth. E. & P. I, 3: 858. 1906.

Plants small to medium size. Leaf cells thick-walled; upper ovoid to oblong-rhomboidal; lower basal cells longer, sublinear; a considerable area of angular cells very small and thick-walled, rounded quadrate to subcircular. Dioicous. Capsules nearly erect and symmetric, occasionally slightly unsymmetric and cernuous; seta smooth; peristome perfect, the base of the teeth marked with the fine transverse lines characteristic of the Hypnaceae. A genus of our Pacific coast. Type species *B. longipes* (Sull. & Lesq.) Broth.

The peristome clearly allies this unusually homogeneous genus with the Hypnaceae. *B. Breweriana* is surely more closely related to the other two species than to *Tripterocladum* with its leaves nearly ecostate and peristome without cilia.

KEY.

- | | |
|---|---------------------|
| 1. Branch leaves mostly obtuse and rounded at apex. | <i>Holzingeri</i> . |
| Branch leaves mostly sharply acute. | 2. |
| 2. Leaves closely appressed and branches julaceous when dry. | <i>Breweriana</i> . |
| Leaves subcomplanate, branches flattened. | <i>longipes</i> . |

BESTIA HOLZINGERI (R. & C.) Broth. E. P. I, 3: 858. 1906.

Thamnium Holzingeri R. & C. Bot. Gaz. 19: 239. 1894. *pl. 22 A*.

"Green, slender, rather resembling in habit the small forms of *Pseudisotheceum myosuroides*. Primary stems creeping, stoloniferous, secondary ascending or decumbent, more or less shrub-like, pinnate, branches complanate, generally attenuate; lower stem leaves small, erect-spreading from a broadly deltoid base, ligulate-obtuse; costa vanishing about the base of the acumen; upper leaves larger, distichous, complanate, slightly asymmetric at the base, oblong-ligulate, obtuse or subobtuse, costa vanishing far from the apex, sometimes forking above; branch leaves smaller with the costa shorter and the lower margin inflexed, the upper leaves acute; all the leaves plane and crenulate-serrate on the margins, coarsely and irregularly dentate at the apex; areolation parenchymatous, cells incrassate, short, chlorophyllose, roundish or sub-hexagonal above, ovate or oblong in the middle, sublinear below, the alar small, rather obscure, subquadrate or roundish. Inner perichaetial bracts subvaginant, oblong-lanceolate, long loriform-acuminate, serrulate, costa thin, cells narrower; vaginule covered with numerous long paraphyses. Pedicel smooth, reddish, short (6-9 mm.). Capsule erect, oblong, subsymmetric, constricted under the orifice when dry, lid conic, obliquely beaked. Teeth of the peristome yellowish, lanceolate-acuminate, subulate, segments narrowly split along the divisural line, cilia 2, long, nodose. Seems to be dioecious."

As the species has not been widely collected I have quoted the original description in full, but I offer the following additions and corrections. The costa in the upper stem leaves extends $\frac{1}{2}$ the length of the leaf; upper leaf cells oblong-hexagonal to rhombic, 15-18 μ long, about 2 : 1; a few lower basal cells oblong to oblong-rhomboidal or sublinear, 20-30 μ long, 4-5 : 1; middle branch leaves about 1 mm. long. Perichaetial leaves with spreading tips, the inner abruptly and narrowly long-acuminate, (acumination $\frac{1}{2}$ as long as the rest of the leaf) serrate from the middle to base of the slender acumination, then sparingly dentate along its sides and sharply dentate at its apex: spores about 12 μ in diameter; capsules ovoid, about 1.5 mm. long, often somewhat cernuous; cilia appendiculate, nearly as long as the segments.

I do not find the costa in the branch leaves shorter and Cardot's figure shows the serrations on the leaf more correctly than his description.

Type from Myrtle Point, Coos Co., Oregon.

Pacific Coast, California to Vancouver. Apparently rare. Only 4 collections known to me.

ILLUSTRATIONS.—Cardot, l. c. (part of which is here reproduced in *Pl. 2*).

EXSICCATI.—Grout, N. Am. Musc. Pl. 15 (as *Porotrichum*).

A unique and pretty species that when sterile probably would be placed in *Neckera* or *Homalia*, but its peristome is of the perfect hypnaceous type.

BESTIA LONGIPES (Sull. & Lesq.) Broth. E. & P. I, 3: 859.

Alsia longipes Sull. & Lesq. Musc. Bor.-Am., Ed. 2, no. 399; and Sull. Icon. Musc. Suppl. 85, pl. 63.

Plants in soft diffused mats, light green; secondary stems ascending, pinnately to bipinnately branching almost from the base, frondiform, 3-5 cm. long, somewhat complanate-foliate; stem leaves ovate-lanceolate to triangular ovate, acute, serrate above, concave, margins recurved below; costa stout, extending well into apex, toothed on the back; leaf cells thick-walled, upper oblong-ovoid, about 15 μ long, 2 : 1; lower cells more elongated, reaching 23 μ , 3-4 : 1; a large area of alar cells thick-walled and rounded quadrate, colored, branch leaves oblong-lanceolate, smaller, more coarsely serrate at apex; elongated basal cells few or wanting, apex sometimes more rounded than figured; perichaetial leaves squarrose-spreading at apex, abruptly long-filiform acuminate, dentate above, inner costate. Dioicous. Antheridia mainly on the branches. Seta about 1.5 cm. long, borne on secondary stems; capsule cylindric; operculum obliquely rostrate; peristome perfect; teeth long and slender; segments a little shorter, split between the articulations; cilia two, somewhat shorter than the segments, appendiculate.

Type from California, Bolander.

ILLUSTRATIONS.—Sullivant, l. c.; Pl. 2.

EXSICCATI.—Sull. & Lesq., l. c.; Grout N. Am. Musc. Pl. 496.

BESTIA BREWERIANA (Lesq.) n. comb.

Hypnum (Isothecium) Brewerianum Lesq. Trans. Am. Phil. Soc. 13: 12. 1863.

Tripterocladium Brewerianum (Lesq.) Fleisch. Laubm. von Java. 1906.

Hypnum aggregatum Mitt. Journ. Linn. Soc. 8: 35. 1865. pl. 6.

Plants in compact dark green or occasionally yellowish green tufts; secondary stems ascending, bearing a few multicellular subfoliose paraphyllia, crowded, from a more or less prostrate primary stem, fasciculately branching; branches nearly simple, attenuate, curved and julaceous when dry, sometimes flagelliform; leaves imbricate and closely appressed when dry, erect-spreading when wet; lower stem leaves broadly ovate, abruptly acuminate, sharply serrate from base of acumen up; costa wide, ending near the middle; middle branch leaves broadly oblong-lanceolate to broadly ovate-lanceolate, concave below with reflexed margins, acute, sharply serrate above; costa usually extending well beyond the middle, often ending in a spine at back; upper leaf cells oblong-rhomboidal, 20-30 μ long by about 8 μ wide; median cells gradually elongated toward the base; basal cells linear-oblong, reaching 45 \times 8 μ ; basal angles with a large area of small thick-walled roundish-quadrate cells that reach $\frac{1}{3}$ - $\frac{1}{2}$ the distance to the costa and about $\frac{1}{4}$ the way up the leaf margin; inner perichaetial leaves oblong-lanceolate, slenderly long-acuminate, serrate above, faintly costate, with spreading tips. Sometimes monoicous. Seta 10-15 mm. long, smooth; capsule erect or nearly so, oblong-cylindric, usually somewhat unsymmetric, contracted under the mouth when dry; urn 1.5-2 mm. long; operculum conic-rostrate, often oblique, 0.5 mm. or more long; peristome perfect; teeth with very long slender tips which are spinose-papillose; segments as long as the teeth, open between the articulations, papillose; "cilia two, robust, equal to the segments"; annulus present, well developed; spores 15 μ in diameter, minutely roughened, maturing in winter. Type from California.

California to Vancouver. Frequent.

ILLUSTRATIONS.—Mitten, l. c.; Pl. 2.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. Ed. 2, 426; Macoun, Canadian Musci 294; R. & C. Musc. Am. Sept. Ex. 114; Grout, N. Am. Musc. Pl. 21, 21a, 432, 468.

Var. *LUTESCENS* L. & J. Manual, 349. 1884.

"Pale dirty yellow; branches longer, stoloniferous; perichaetial leaves shorter, acuminate, serrulate; areolation shorter and broader; capsule longer, subcernous; cilia slender." Sull. & Lesq., Musc. Bor. Am. Ed. 2, 427, issued as this var. has little to distinguish it except shorter perichaetial leaves and a slightly more unsymmetric capsule.

Var. *HOWEI* (Kindb.) n. comb.

Isothecium Howei Kindb. Rev. Bryol. 22: 82. 1925.

Dirty green; differs from typical forms in being much more slender; many branches stoloniferous; branch leaves oblong-lanceolate, narrowly long-acuminate; upper leaf cells oblong-linear, 30-40 μ long.

Type from beams of the "Old Mill," Mill Valley, Marin Co., California, Jan. 16, 1892. M. A. Howe.

Pl. 2.

I have a type duplicate from Dr. Howe himself, and if this form had a normal habitat and were of frequent occurrence, I should consider it of specific rank.

A form of *Breweriana* collected on stumps in Mill Valley in 1892 and by A. S. Foster on a boulder near

the summit of Waldron Island, Puget Sound, July 6, 1907, has branch leaves longer acuminate than typical and upper leaf cells nearly as long as in var. *Howei*, yet the general leaf form was little different from typical *Breweriana* and the Mill Valley type is almost certainly an extreme habitat form or possibly a hybrid with the abundantly occurring and protean *Pseudisothecium stoloniferum*. Indeed, if it were not for the much larger area of small thick-walled cells in *B. Breweriana* it would be almost impossible to distinguish sterile forms of one from the other. Var. *Howei* has as slender pointed leaves as many forms of *P. stoloniferum* while the branch leaves of its var. *myurellum* (Kindb.), are as blunt as any of *B. Breweriana*. I strongly suspect that some of the many other puzzling forms of these two species are hybrids.

While the habit of *B. Breweriana* is somewhat different from that of the two other species, its microscopic structure is surprisingly similar. It also shows unmistakable relationship to *Pseudisothecium myosuroides*. My judgment does not make *Isothecium myurum* Brid. congeneric with *P. myosuroides* although the weight of opinion is against me. This genus and its allies belongs in the Hypnaceae near *Eurhynchium*, not in the Lembophyllaceae.

The description of *Isothecium hylocomiodes* Kindb. Eur. & N. Am. Br. 35. does not differentiate it in any way from a mere form of *B. Breweriana*.

Subfamily BRACHYTHECIEAE.

Hypnaceous mosses differing but little in general appearance from many of the Hypnæ, nearly always more or less glossy. The leaves are straight and imbricated when dry, occasionally loosely spreading, erect-open when moist; very rarely falcate or secund except in *Brachythecium velutinum* and its allies, often strongly plicate or sulcate, at least when dry, simply costate half way or more, leaf-cells linear-vermicular (except *B. reflexum*, *B. digastrum* and *B. cyrtophyllum*). Alar cells differentiated, often inflated and hyaline, sometimes quadrate and densely chlorophyllose.

Capsules brown to chestnut-brown, ovoid, short, cernuous and unsymmetric except in *Homalotheciella* and in *B. oxycladon*, and *B. acuminatum* and its allies, rarely or never plicate or strongly contracted under the mouth when dry; operculum conic, conic-apiculate or long-rostrate, seta often roughened with prominent papillæ, peristome perfect except in species having erect capsules.

KEY.

- | | |
|--|---|
| 1. Leaves markedly papillose at back with projecting cell angles. | <i>Bryhnia</i> . |
| Leaves not papillose at back (somewhat so in <i>Pseudisothecium</i> and <i>Camptothecium</i> species)..... | 2. |
| 2. Leaves strongly plicate | 3. |
| Leaves often concave with reflexed or recurved margins but rarely strongly plicate | 5. |
| 3. Capsules erect and symmetric or nearly so; cilia of peristome rudimentary or wanting | <i>Homalothecium</i> . |
| Capsules more or less curved and cernuous..... | 4. |
| 4. Plants usually bright glossy yellow-green, often regularly pinnate..... | <i>Camptothecium</i> . |
| Plants usually darker green, less glossy and seldom regularly pinnate..... | <i>Brachythecium</i> sp. |
| 5. Leaves very concave, spoon-shaped, abruptly long filiform-acuminate..... | <i>Cirriphyllum</i> . |
| Leaves rarely so strongly concave or so slenderly acuminate, never both..... | 6. |
| 6. Operculum long-rostrate; apical cells of branch leaves usually shorter and broader | <i>Eurhynchium</i> and <i>Rhynchostegiella</i> . |
| Operculum conic to conic-rostrate; apical cells rarely much different..... | 7. |
| 7. Capsules erect and symmetric or nearly so..... | 8. |
| Capsules more or less cernuous and curved..... | 9. |
| 8. Calyptra hairy; segments adhering to the teeth of peristome..... | <i>Homalotheciella</i> . |
| Calyptra smooth; peristome perfect, or cilia sometimes short or lacking..... | <i>Chamberlainia</i> and <i>Brachythecium</i> sp. |
| 9. Branches julaceous; leaves concave; leaf cells very long and narrow, 10-20 : 1; seta rough; all western..... | <i>Scleropodium</i> . |
| Branches seldom julaceous; leaf cells usually shorter; seta smooth or rough.... | 10. |
| 10. Leaves often slightly papillose at back; seta smooth; a large area of small thick-walled, rounded alar cells; rare and alpine in the East..... | <i>Pseudisothecium</i> . |
| Leaves not papillose; seta often rough; alar cells much less numerous or enlarged, often thin-walled and clear; widely distributed..... | <i>Brachythecium</i> . |

PSEUDISOTHECIUM nov. gen.

Isothecium Brid. Bryol. Univ. 2: 255. 1827, in part.

Differs from *Isothecium* in its unsymmetric and cernuous capsules and peristomes with well developed cilia; from *Eurhynchium* in the scarcely rostrate operculum and larger area of rounded-quadrate angular cells, in this last it also differs from *Brachythecium*. Type species *P. myosuroides*.

While there is no doubt of the close relationship of the species here included and the European *Isothecium viviparum* (Neck.) Lindb. [*I. myurum* (Pollich.) Brid.], I have consistently held to the opinion that the erect capsule together with the absence of cilia in the peristome is a sufficient basis for generic distinction in the Hypnaceae.

KEY.

- Branches seldom flagelliform; branch leaves 1-1.5 mm. long; plants of eastern North America. *myosuroides*.
Branches often very long-flagelliform; branch leaves 1.5-2 mm. long; plants of the Pacific slope. *stoloniferum*.

PSEUDISOTHECIUM MYOSUROIDES (Dill. L.) n. comb.

Isothecium myosuroides (Dill. L.) Brid. Bryol. Univ. 2: 369. 1827.

Hypnum myosuroides tenue capsulis nutantibus Dill. Hist. Musc. 317, pl. 41, f. 51. 1741, and Herb.

Hypnum myosuroides L. Sp. Pl. 1130. 1753.

Eurhynchium myosuroides Schimp. Syn. Ed. 1: 549. 1860.

Plants in soft intricate light green to brownish green tufts; primary stems creeping, secondary stems 15-25 mm. long, suberect, dendroid and often stoloniferous, frequently becoming arcuate and giving off dendroid innovations like *Hylocomium proliferum*; branching subpinnate to fasciculate; branches often again divided; ultimate branchlets 5-8 mm. long, sometimes flagelliform and much lengthened; branch leaves somewhat secund, ovate-lanceolate to oblong-lanceolate, 1-1.3 × 0.25-0.35 mm., acute to long-acuminate, serrulate at apex, sometimes papillose at apex on the back by the thickening of the angles of the cell walls; costa extending to the middle or beyond, sometimes forking; median leaf-cells linear, 5-7 : 1; alar cells round-quadrate, incrassate; stem leaves triangular-ovate, long-acuminate, less strongly serrate, basal cells often thick-walled and brown; leaves of primary stems very small, distant, squarrose; paraphyllia none: inner perichaetial leaves with an ovate-lanceolate sheathing base and a long squarrose-recurved acumination, serrate above, costate. Dioicous. Seta smooth, twisted to the left above or often irregularly bent and twisted, 1.5-2 cm. long; capsule brown, oblong-ovoid, suberect, and slightly unsymmetric to horizontal and curved, 2-2.5 mm. long, 3-4 : 1; operculum conic, apiculate to short-rostrate; annulus of 2-3 rows of cells, easily deciduous; segments from a wide basal membrane, as long as the teeth, more or less split along the median line; cilia 2 or 3, nearly as long as the segments; spores minutely roughened, about 16 μ , maturing in autumn or early winter.

Type locality European; type at Oxford in the Dillenian herbarium.

In cool shady places on rocks and roots of trees in alpine and boreal regions. Rare in America. Trinity Bay, Newfoundland, Waghorne; Nova Scotia, James; White Mts. (North Conway) N. H., Oakes; Grandfather Mt., N. Carolina, Andrews.

ILLUSTRATIONS.—Dill. l. c.; Br. & Sch., Bry. Eur. pl. 534; Pl. 3.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 424.

Our eastern plant agrees very closely with the European *P. myosuroides*, but the western form referred to this species is quite different in a number of characters and I believe it should all be referred to *P. stoloniferum* (Hook). The only western specimen examined that seemed at all doubtful was from Guadalupe Island, Lower California, collected by Edward Palmer (no. 115) in 1875. The circumstances were such that the accuracy of this label is doubted. An exceedingly variable species especially in leaf characters.

Var. *filicescens* Ren. & Card. is a slender form with branches often flagelliform. For the distinctions between this species and *P. stoloniferum* see notes under that species.

PSEUDISOTHECIUM STOLONIFERUM (Hook.) n. comb.

Isothecium stoloniferum (Hook) Brid. Bry. Univ. 2: 371. 1827.

Hypnum stoloniferum Hook. Musc. Exot. 1: pl. 74. 1818.

Eurhynchium stoloniferum Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 347. 1878.

Hypnum myosuroides stoloniferum C. Muell. Syn. 2: 500. 1851.

Hypnum spiculiferum Mitt. Journ. Linn. Soc. 8: 34. 1865.

Hypnum acuticuspis Mitt., l. c.

Isothecium pleurozoides Kindb. Can. Rec. Sci. 1894: 19. 1894.

Isothecium obtusatum Kindb. Can. Rec. Sci. 1894: 19. 1894. (Roell 117, Vancouver), fide Cardot, Hedwigia, 35: 310. 1896.

Plants in wide, soft, loosely intricate tufts, light green to brownish green, often glossy; primary stems slender, long-creeping, radiculose, furnished with minute distant leaves; secondary stems dendroid, suberect, 5 cm. or more long, very much branched; branches two or three times divided, of varying length, often long-flagelliform, branches and branchlets inclined to one side; branch leaves varying greatly in habit, spreading to loosely imbricate when dry, sometimes subsecund, $1.5-2 \times 0.3-0.4$ mm., oblong-lanceolate to ovate-lanceolate, acuminate with point often twisted to the right, serrulate below, coarsely serrate above, smooth or papillose on the back by the thickened angles of the cell walls, margins often slightly revolute below; costa extending to the middle or beyond, often ending in a spine on the back; median leaf-cells linear, rather thick-walled, $7-10:1$; alar cells round-quadrate, incrassate and indistinct; apical leaves of branchlets attenuate; leaves of creeping stems scale-like, 0.7 mm. long, narrowly acuminate, subdenticulate, costate to the middle; leaves of erect stems like those of creeping stems only larger with costa sometimes forking, gradually enlarged and elongated above, where they approach the branch leaves in shape and size; leaves of the flagella distant, slender, lanceolate, often very long-acuminate, serrate. Dioicous. Inner perichaetial leaves with broad sheathing bases and long-acuminate squarrose apices, serrate above or nearly entire; costa thin, sometimes wanting; paraphyses very numerous, long, composed of two or more rows of cells at base. Sporophyte much as in *P. myosuroides*; capsule ovoid, 2-2.5 mm. long, 2.5-3.1.

Type locality, western part of western North America; Menzies, 1787.

On the ground, trees, and rocks in woods. Apparently common on the Pacific coast. Alaska, Miss Cooley; Colorado, Shockley.

ILLUSTRATIONS.—Brid. l. c.; Hook. l. c.; Pl. 3.

EXSICCATI.—Macoun Can. Musc. 292 in part, 291 (*Isothecium myosuroides*), 293 (*Hypnum spiculiferum*), 656 (*Isothecium pleurozoides*). Grout, N. Am. Musc. Pl. 57, 85a, 86, 87.

An exceedingly variable and perplexing species. The papillose character of the leaves is of no value whatever as a distinction, as the leaves of European *P. myosuroides* are frequently papillose and this character varies even on leaves of the same plant. I have seen type specimens of *Hypnum acuticuspis* Mitt. and *Hypnum spiculiferum* Mitt. The specimens of *H. spiculiferum* were larger and had larger, longer acuminate leaves on the secondary stems than is usually the case with *P. stoloniferum*, but there were two well-developed cilia with rudiments of a third. It appears to be a well-developed form of *P. stoloniferum*. *Isothecium pleurozoides* is a broad-leaved form varying in the direction of var. *myurellum*.

P. stoloniferum differs from *P. myosuroides* in its larger size, more frequent and better developed flagellate branches, in the longer branch leaves with a broader and more gradually narrowed acumination, and broader and longer median cells. The stem leaves also are slightly rounded at the basal angles, as broad as long and narrowed to a comparatively long slender acumination.

Var. CARDOTI (Kindb.) n. comb.

Isothecium Cardoti Kindb. Bull. Torr. Bot. Club, 17: 278. 1890.

Bright glossy yellow-green; secondary stems irregularly pinnately branching, 5-10 cm. long, sometimes bearing long rigid flagella at the ends; branch leaves reaching 3 mm. in length by 0.7 mm. in breadth.

EXSICCATI.—Grout, N. Am. Musc. Pl. 49, 85; Allen, Mosses Cascade Mts. 111a, 111b, 112.

A beautiful variety representing the maximum development of the species. So large and striking is it in appearance that at first sight one feels that it must surely be a distinct species, but there is a whole chain of common and intermediate forms. The species itself is one of the most variable known to me, thus making it impossible to base a distinct species on a form whose principal difference is mere size. It is possible that *P. stoloniferum* itself should be regarded as a subspecies of *P. myosuroides*, but some specific lines seems imperative between such divergent forms as the European *P. myosuroides* and *Isothecium Cardoti* Kindb.

Type locality, Hastings, B. C. On base of trees and logs. Victoria, Vancouver Id.; Washington.

EXSICCATI.—Macoun, Can. Musc. 394.

Var. MYURELLUM (Kindb.) n. comb.

Isothecium myurellum Kindb. l. c.

Branches seldom flagelliform, having a much smoother subjulaceous appearance due to the shorter, more appressed leaves; branch leaves ovate-lanceolate to ovate-elliptical, obtusely acute to short-acuminate, $1-1.2 \times 0.3-0.4$ mm., coarsely, often doubly, serrate above, concave; median cells 5-7:1, the upper shorter and broader; apical cells rhombic-elliptical, 2-3:1; round-quadrate alar cells more numerous.

On stones and decaying logs.

Type from Victoria and Nanaimo Rivers, Vancouver Island. Colorado, (Shockley); Vancouver Island, (Macoun); Marin and Sonoma Counties, California, (M. A. Howe).

EXSICCATI.—Macoun, Can. Musc. 397, and 292 in part.

ILLUSTRATIONS.—Pl. 2.

By reason of its habit and short-pointed branch leaves with well differentiated apical cells, this variety also seems a good species at first sight, but all the intermediate forms of leaves can frequently be found in the same tuft and sometimes even on the same plant.

Cardot (Bull. Herb. Boissier 7: 340. 1899) came to the conclusion Hooker's type of *I. stoloniferum* was the form described by Kindberg as var. *Cardoti* and he proposed the name *substoloniferum* for the form commonly regarded as *I. stoloniferum*. As Cardot did not, as I understand it, see Hooker's type but only specimens he regarded as authentic, I hesitate to make the change until the type is consulted.

Cardot also states, l. c., p. 342 that *I. thamnoides* Kindb. Eur. & N. Am. Br. 36, is a var. of *stoloniferum*. (See notes under *Homalothecium Nuttallii*.)

BRYHNIA Kaurin, Bot. Not. 1892: 60. 1892.

(Named for the discoverer of the European representative of the genus, Dr. Nils Bryhn.)

Plants medium sized, in intricate mats or cushions, bright green on the surface, dirty brownish green below. Stems creeping, irregularly divided and branching; central strand present. Leaves concave, serrate, decurrent, conspicuously papillose on the lower surface by the greatly thickened angles of the cell walls; median leaf-cells short, 4-6 : 1, rather thick-walled; basal and alar cells a little larger and more nearly rectangular. *Sporophyte* much as in *Brachythecium*. Seta rough, twisted to the right; capsule short-oblong, somewhat arcuate; operculum long-conic to subrostellate; annulus present, well developed; cilia one or two, well developed, nodose.

The two species referred to this genus (previously known as *Eurhynchium Sullivantii* and *Brachythecium Novae-Angliae*) are undoubtedly very closely related and congeneric but the question of their further relationship is more difficult. They are seemingly intermediate between *Brachythecium* and *Eurhynchium* and were so regarded by the author of this genus. The shortness of the leaf-cells is a character that does not pertain to *Brachythecium* (except in the anomalous *B. reflexum* and *B. cyrtophyllum*). The thickening of the angles of the cell walls to form papillae is so distinct in no species of *Brachythecium* and is much more strongly marked than in any other species referred to *Eurhynchium*.

KEY.

Branch leaves acute to short-acuminate, apex twisted. *Novae-Angliae*.
Branch leaves longer acuminate, apex not twisted. *graminicolor*.

BRYHNIA NOVAE-ANGLIAE (Sull. & Lesq.) Grout, Bull. Torr. Bot. Club 25: 229. 1898.

Hypnum Novae-Angliae Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 338. 1856. Sull. Mosses of the U. S. 76. 1856.

Brachythecium Novae-Angliae Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 338. 1878.

Hypnum scabridum Lindb. Bot. Not. 1887: 41. 1887.

Eurhynchium Novae-Angliae Kindb. Can. Rec. Sci. 1894: 23. 1894.

Hypnum (Cratoneuron) chloropterum C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 231. 1892.

Plants in wide loosely intricate mats, bright green on the outside, dirty brownish green below, stems decumbent; secondary stems suberect, about 5 cm. long, subpinnately branching; branches erect-ascending, terete-foliate, often subjulaceous, 5-10 mm. long; branch leaves erect-open, loosely appressed-imbricate when dry, ovate to ovate-lanceolate, decurrent, 0.8-1.2 × 0.4-0.6 mm., serrulate, very concave, not plicate, papillose on the under side by the thickened angles of the cell walls, long-acute to short-acuminate; apex twisted one-half turn to the right; costa thick, extending beyond the middle of the leaf; median leaf-cells oblong-hexagonal, 5 : 1; alar and basal cells little differentiated, somewhat enlarged; stem leaves broadly ovate to triangular-ovate, 1-1.4 × 0.8-1.2 mm., nearly smooth, longer acuminate; leaf-cells shorter, areolation of decurrent angles somewhat more loose and more nearly rectangular; perichaetium about 2 mm. long; the leaves with sheathing bases and squarrose points; inner leaves oblong, long-filiform acuminate, somewhat serrulate above, costate. Dioicous. Seta dark red-brown, 1-2 cm. long, very rough with broad low papillae; capsule dark red-brown, almost black when old, oblong-cylindric, 3-3.5 mm. long, 4-5 : 1, somewhat arcuate, horizontal to suberect; operculum long-conic, subrostellate; annulus large; segments

nearly as long as the teeth; cilia one or two, nearly as long as the segments, strongly nodose; spores minutely roughened, 17-19 μ , maturing in autumn or winter.

Type locality, mountains of New England.

On earth and stones in wet shady places, especially in mountain regions. Northeastern United States and eastern Canada; south to Maryland; west to Pennsylvania.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 118. Limpr. Rab. Krypt. Pl. 4²: 139, f. 377 (*Bryhnia scabrada*). M. H. M. p. 288.

EXSICCATI.—Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 338, (Ed. 2) 507; Aust. Musc. Appal. 329; Macoun, Can. Musc. 440; R. & C. Musc. Am. Sept. Exsic. 109; Grout, N. Am. Musc. Pl. 20.

Easily distinguished by its rostellate capsule, short papillose leaf cells and twisted leaf apices. The species varies considerably in length of the acumination of leaves so that var. *Delamarei* R. & C. Fl. Miq. 50, does not seem worthy of special mention, although I have not seen specimens of that form.

Var. FONTINALIS Grout, Bryologist 11: 29. 1908.

Very slender and attenuate with leaves distant. (Grout, N. Am. Musc. Pl. 315.) Around cool spring under overhanging rocks. Pink Beds, Transylvania Co., North Carolina, Alt. 3500 ft. Type in herb. A. J. G.

The late D. A. Burnett sent me a peculiar form of this species from Bradford, Pa., growing on fine sand near the borders of a stream. The whole plant is much reduced and the leaves are more slenderly acuminate than usual.

BRYHNIA GRAMINICOLOR (Brid.) Grout, Bull. Torr. Bot. Club 25: 231. 1898.

Hypnum graminicolor Brid. Spec. Musc. 2: 251. 1812.

Hypnum praelongum var. Sull. Musc. Allegh. 44. 1845.

Hypnum Sullivantii Spruce, A. Gray, Man. Ed. 1. 1848.

Eurhynchium subscabridum Kindb. Ottawa Nat. 7: 22. 1893.

Eurhynchium Sullivantii Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876.-77: 354. 1878.

Plants slender, in closely intricate mats or cushions, pale-green to yellow-green, dirty-brownish green below, stems 1-2.5 cm. long, creeping, irregularly divided and branching, sometimes stoloniferous, sparingly radiculose, often brown and denuded of leaves; branches ascending, 5-10 cm. long, terete-foliate; branch leaves loosely imbricate to open erect, ovate-lanceolate, 0.6-0.8 \times 0.25-0.3 mm., decurrent, acuminate, sharply serrate nearly to base, concave with margins reflexed below, strongly papillose by the thickening of the angles of the cell walls; median leaf-cells small, linear-oblong, 4-6: 1; quadrate alar cells few; stem leaves 0.75-1 \times 0.4-0.45 mm., longer, and more slenderly acuminate: perichaetial leaves sheathing with spreading points; the inner oblong-lanceolate, abruptly long filiform-acuminate, distantly serrulate, often with traces of a costa. Dioicous. Seta 10-15 mm. long, red-brown, slightly twisted to the right, very rough with large crowded papillae; capsule red-brown, ovoid to subglobose, urn 1.5 mm. long and about two-thirds as broad; operculum short-rostrate, scarcely more than long-conic when moist, one-half length of urn; annulus present, easily detachable; teeth very slenderly pointed; segments shorter than the teeth, little or not at all split; cilia two, well developed, nodose; spores nearly smooth, 13-15 μ , apparently maturing in autumn.

Type locality, Pennsylvania, Muhlenberg. Type at Geneva.

On the ground or rocks in moist and shady places. New Brunswick to Minnesota, Illinois, and Georgia; Missouri, Bush.

Local and rarely fruiting. Reported from Vancouver Island, Roell, Hedwigia, 35: 69. 1896, but probably a mistake.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 105. M. H. M., 289.

EXSICCATI.—Sull. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 291, (Ed. 2) 430; Aust. Musc. Appal. 334; Macoun, Can. Musc. 296; Grout, N. Am. Musc. Pl. 191, 191a, 257.

Distinguished from *B. Novae-Angliae* by its more slender habit, smaller and more slenderly acuminate leaves, which are much more strongly papillose.

Var. HOLZINGERI (R. & C.) Grout, l. c.

Eurhynchium Sullivantii Holzingeri R. & C. Bot. Gaz. 19: 239. 1894.

More densely caespitose; branches shorter, generally obtuse; leaves broader, shorter acuminate.

Type locality in the District of Columbia, Coville. New Jersey, Best; Missouri, Demetrio.

This is the extreme variation in the direction of the characters noted above. The other extreme is reached in Drummond's Musc. Am. (S. States) 133 and R. & C. Musc. Am. Sept. Exsic. 196, which is more straggling and stoloniferous; branch leaves more distant and open, lanceolate, reaching 1 mm. in length

by 0.25 to 0.3 in breadth, long subfiliform-acuminate, very strongly dentate-serrate and very strongly papillose-roughened; stem leaves ovate-lanceolate, longer acuminate, reaching 1.3 mm. in length.

EURHYNCHIUM Br. & Sch. Bry. Eur., fasc. 57-61. 1854.

Plants well developed, never minute, green to yellow-green, growing in wide loose mats, or sometimes in dense tufts. Stems prostrate or creeping, more or less pinnately branched, sometimes closely and regularly pinnate, usually somewhat stoloniferous; central strand present in all the species. Branch leaves not complanate or secund, acuminate to obtuse, serrate, concave, more or less plicate; costa single, extending to the middle or beyond, usually ending in a spine underneath; median cells linear, 8-12 : 1, basal broader and shorter, alar quadrate or round, apical cells strongly differentiated and rhomboidal to circular in the group of *E. strigosum*. Stem leaves ovate, acute to slenderly long-acuminate. Paraphyllia sparingly present in some species. *Sporophyte* as in *Brachythecium*, except the operculum, which is very long-rostrate, equaling $\frac{1}{2}$ - $\frac{1}{3}$ the length of the urn.

The species of this genus are quite closely related to *Scleropodium* and *Brachythecium*, and it is difficult to give any general character, except the long-rostrate operculum, which distinguishes this genus from *Brachythecium*. It is distinguished from *Scleropodium* by the broader, shorter leaf-cells.

KEY.

- | | |
|---|----------------------------------|
| 1. Apical cells of branch leaves oblong-rhomboidal to circular..... | 2. |
| Apical cells of branch leaves not differentiated..... | 7. |
| 2. Seta rough..... | <i>hians</i> and <i>Rappii</i> . |
| Seta smooth..... | 3. |
| 3. Aquatic, growing on stones in streams..... | <i>rusciforme</i> . |
| Terrestrial, usually growing on soil..... | 4. |
| 4. Leaves erect-spreading..... | 5. |
| Leaves appressed-imbricate..... | 6. |
| 5. Branch leaves 0.6-0.9 mm. long..... | <i>strigosum</i> . |
| Branch leaves 1-1.5 mm. long, round-obtuse at apex..... | <i>fallax</i> . |
| 6. Alpine or boreal; usually in dense mats or cushions; slender..... | <i>diversifolium</i> . |
| Lowland; in looser mats; more robust..... | <i>strigosum praecox</i> . |
| 7. Seta smooth or nearly so..... | 8. |
| Seta rough..... | 9. |
| 8. Terete-foliate, western..... | <i>Brittoniae</i> . |
| Complanate-foliate, eastern..... | <i>serrulatum</i> . |
| 9. Slender, variously branching; leaves not more than 1 mm. long..... | <i>praelongum</i> . |
| Very robust, closely and regularly pinnate; branch leaves 1-1.5 mm. long..... | <i>oreganum</i> . |

EURHYNCHIUM HIANS (Hedw.) Jaeger. & Sauerb., St. Gall. Nat. Gesell. 1876-77: 357. 1878.

Hypnum hians Hedw. Sp. Musc. 272, pl. 70, f. 11-14. 1801.

Hypnum praelongum Hedw. St. Cr. 4: 76, pl. 29. 1797.

Eurhynchium praelongum Br. & Sch. Bryol. Eur. fasc. 57-61. pl. 8 (excl. var.). 1854.

Hypnum distans Lind. Musc. Scand. 34. 1879.

Plants in intricate, depressed mats, green to yellow-green, closely adherent to the substratum; stems 3-10 cm. long, creeping, strongly radiculose, little divided, extensively stoloniferous, irregularly to sub-pinnately branching; branches ascending, nearly simple, 3-12 mm. long; branch leaves erect-spreading, appearing complanate when dry, 0.8-1.1 × 0.5-0.7 mm., ovate, not decurrent, obtusely acute to short-acuminate with apex often twisted to the right, sharply serrate to the base, concave to nearly plane, sometimes appearing papillose by the thickening of the angles of the cell-walls; costa stout, extending $\frac{1}{2}$ - $\frac{3}{4}$ length of leaf, ending in a spine on the lower side of the leaf; median cells linear-oblong, 6-10 : 1; quadrate alar cells few, indistinct; apical cells rhombic, 2-3 : 1; leaves of stoloniferous stems small, 0.4-0.6 × 0.2-0.3 mm., ovate-lanceolate, rather abruptly narrowed into a slender acumination; costa thin and short; upper stem leaves much like branch leaves, short-acuminate; perichaetial leaves oblong-ovate, sheathing, rather abruptly narrowed to a long squarrose-recurved acumination, nearly ecostate, distantly dentate-serrate above. Dioicous. Seta 10-25 cm. high, dark red-brown, somewhat twisted to the right, very rough

with low rounded papillae; capsule a little lighter colored, inclined to horizontal, oblong-cylindric, curved, urn 2-2.5 mm. long, 3 : 1, little or not at all contracted under mouth when dry; operculum long-rostrate, three-fourths length of urn; annulus present, narrow, easily detached; segments nearly as long as teeth, more or less split; cilia usually 2, sometimes 3, strongly nodose; spores nearly smooth, 10-12 μ , maturing in late autumn.

On the ground in moist shady places. Canada to the Gulf of Mexico east of the Mississippi; Minnesota, Holzinger; Missouri, Bush.

Type locality, Pennsylvania.

EXSICCATI.—Drumm, Musc. Am. (S. States) 134; Sull. Musc. Allegh. 53; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 290, (Ed. 2) 428; Aust. Musc. Appl. 335; R. & C. Musc. Am. Sept. Exsic. 118 (*E. praelongum*); Grout, N. Am. Musc. Pl. 194, 419.

ILLUSTRATIONS.—Sull. Icon. Musc. pl. 104, as *E. praelongum*; Hedw. l. c., Br. & Sch. l. c., as *E. Swartzii*; M. H. M. 290.

To sum up: There is a very great range of variation in several characters, especially in the width of the branch leaves and the length and slenderness of their acumination. The apex of the branch leaves of the European plant is slenderly acuminate in a larger proportion of cases than in the American, and the seta of the European plant averages longer.

E. hians is generally credited to Europe but the distinctions given by Limpricht will not hold*. If two species are to be made out of the European plants referred to *E. hians* and *E. praelongum* Hedw., the distinction will have to be based on different characters, one of which will, it seems to me, be the shape of the branch leaves. Our American plant differs considerably in this respect. Specimens from the Southern States have, as a rule, more slenderly pointed branch leaves, but there are all grades of intermediate forms and the difference is too slight to be of specific rank.

EURHYNCHIUM RAPPII (Williams) n. comb.

Oxyrhynchium Rappii Williams, Bryologist, 30: 102. pl. 8. Nov. 1927.

Subspecies of *E. hians*. Loosely complanate-foliate; stem leaves broadly ovate-acuminate, reaching about 1.5 mm. long by 1 mm. broad; costa spinose at back in the upper part; annulus lacking; teeth of peristome with a furrow on the inner plates along the median line that gives the appearance of a pale median band. Type locality, Florida, S. Rapp. Probably occurring in other Gulf States. Pl. 4.

An extremely lax loosely complanate-foliate form. It will be interesting to know whether the lack of annulus and the pale median band of the teeth are accidental or are characteristic of this southern form.

EURHYNCHIUM STRIGOSUM (Hoffm.) Br. & Sch. Bryol. Eur. fasc. 57-61, pl. 519. 1854.

Hypnum strigosum Hoffm., D. Fl. 2: 76. 1796.

Hypnum thuringicum Brid. Musc. Recent. 2: 99. pl. 3. f. 2. 1801.

Hypnum pulchellum Hedw. Sp. Musc. 268. pl. 68. f. 1-4. 1801.

Hypnum velutinoides Voit. Musc. Herbip. 99. 1812.

Plants in wide loose mats, with a habit much like *Brachythecium velutinum*, green to yellow-green, stems creeping, densely radiculose, 5-10 cm. long, often stoloniferous at the ends, pinnately to subfasciculately branching; branches 3-8 mm. long, ascending or erect, terete-foliate, often appearing somewhat complanate-foliate when dry, attenuate at the ends; branch leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly or not at all decurrent, 0.7-1 \times 0.3-0.55 mm., acute or often obtuse, especially towards the ends of the branches, sharply serrate above, concave, little or not at all plicate; costa extending four-fifths length of leaf, ending in a spine underneath; median leaf-cells linear, 7-10 : 1; quadrate and oval alar cells few, apical cells conspicuously shorter and broader, oblong-rhomboidal, 2-3 : 1; stem leaves elongated triangular-ovate, more or less long-acuminate, somewhat decurrent, serrate, 0.9-1.2 \times 0.4-0.6 mm.; apex often twisted half around to the right; leaves of the stoloniferous stems, triangular-ovate, abruptly long-acuminate, ecostate, 0.7-5 \times 0.3 mm.; perichaetial leaves with sheathing bases and spreading points, oblong, narrowed to a slender subfiliform spreading acumination, ecostate, distantly serrate. Dioicous or pseudo-monoicous.

Seta 10-20 mm. long, red-brown, smooth, twisted to the right; capsule brown to red-brown, oblong-ovoid to oblong-cylindric, unsymmetric, inclined to horizontal; urn 2-2.5 : 1, constricted below mouth when dry; operculum $\frac{1}{2}$ - $\frac{3}{4}$ length of urn, abruptly long-rostrate; annulus of 2 or three rows of cells; segments nearly as long as teeth, split; cilia 2 or 3, nodose; spores 10-12 μ , nearly smooth, maturing in autumn.

* See Bull. Torr. Bot. Club 25: 234-238.

Type locality, European.

On the ground, roots of trees, and decaying logs in woods and shady places; seemingly preferring steep shaded banks of ravines.

Ranging from Washington, British Columbia and Alaska to Labrador, south to the White Mountains, the Adirondacks, and the mountains of Colorado.

ILLUSTRATIONS.—Br. Sch. l. c.; Hedw. l. c.; M. H. M. 292.

EXSICCATI.—Grout, N. Am. Musc. Pl. 29, 361.

The leaves of this species and its relatives vary so in shape that any attempt to define species by the degree of acuteness of the leaves or other similar character seems futile.

Var. ROBUSTUM Röll, Hedwigia, 36: 52. 1897.

Eurhynchium strigosum (in part) of American authors.

Plants with the habit of *Brachythecium plumosum*, in wide intricate mats, green to yellow-green; stems creeping, densely radiculose, 5–10 cm. long, often stoloniferous at the ends, pinnately or subfasciculate branching; branches 6–12 mm. long, ascending or erect, often fasciculate divided, terete-foliate, more blunt than in *E. strigosum*; leaves from the middle of the branches erect-spreading, ovate-lanceolate, very slightly or not at all decurrent, 1–1.3 × 0.4–0.5 mm., usually acute; quadrate and oval alar cells confined to the extreme angles; stem leaves 1.2–1.5 × 0.4–0.6 mm., longer acuminate, acumination often subfiliform. *Sporophyte* rather larger than in the typical form.

Type locality, vicinity of Chicago, Illinois. Type duplicate in the herbarium of Columbia University.

Eastern Canada and in the United States from Louisiana to Minnesota and eastward. More abundant northward.

EXSICCATI.—(As *Hypnum strigosum*.) Drumm. Musc. Am. (S. States) 131; Sull. Musc. Allegh. 11; Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 292, in part, (Ed. 2) 431, in part; Aust. Musc. Appal. 332; Macoun, Can. Musc. 295; Grout, N. Am. Musc. Pl. 58.

The great majority of plants from eastern North America that have been referred to *E. strigosum* belong to this variety. Forms agreeing very closely with European *E. strigosum* are not rare in the United States and Canada, and are seemingly more frequent in elevated regions. Intergrading forms are very numerous, diversified, and extremely puzzling.

Var. PRAECOX (Hedw.) Husnot, Musc. Gall. 332. 1893.

Hypnum praecox Hedw. Spec. Musc. 249, pl. 64. 1801.

Plants caespitose or in looser intricate mats, green to yellow-green; stems creeping, 2–3 or even 8 cm. long, irregularly divided, subfasciculate branching, often stoloniferous; branches 3–6 mm. long, erect, julaceous, usually blunt; branch leaves crowded, imbricate-appressed when dry, erect-open when moist, cordate-ovate, more or less decurrent, 0.5–0.8 × 0.4–0.6 mm., almost acute to very obtuse and rounded at apex, serrate above, serrulate nearly to the base, more or less plicate, concave with borders often reflexed below; costa extending at least three-fourths the length of the leaf, ending in a spine underneath; median cells linear-oblong, 6–8 : 1; quadrate and oval alar cells numerous, apical cells rhomboidal to nearly circular; leaves of the stolons much as in *E. strigosum*; stem leaves acute to abruptly filiform-acuminate, triangular-ovate, decurrent, 0.8–1 × 0.6 mm., serrulate, costate to the middle. Seta 6–10 mm. long, capsule ovoid, unsymmetric, horizontal; urn 1.5–2 : 1, more or less contracted under the mouth when dry and empty; operculum two-thirds length of urn, convex, abruptly long-rostrate; cilia 1–3, strongly nodose; spores very finely roughened, about 12 μ , maturing in autumn.

"More depauperate than the species, tufts loose, deep green; stems shortened, thick and nearly naked; branches and branchlets erect, 3–5 mm. long; stem leaves 0.7 mm. long by 0.4 mm. broad, plicate; branch leaves close, appressed-imbricate, broadly ovate, short-acuminate, 0.6 mm. long by 0.3 mm. broad, margins somewhat reflexed above the middle, plicate; the upper branch leaves sometimes obtuse; leaf-cells 6 μ long, 10 : 1, elongated in the acumination; costa extending three-fourths the length of the leaf, ending in a spine on the under side. *Sporophyte* like the species; seldom fruiting." *Limpricht, Rab. Krypt. Fl.* 43: 159. 1897.

On shady banks, moist soil and rocks. New York, New Jersey, Pennsylvania; Texas, G. Jeremy.

Type locality, Sweden.

ILLUSTRATIONS.—Br. & Sch. Br. Eu. pl. 519, f. β ; M. H. M., p. 292.

EXSICCATI.—Drumm. Musc. Am. (S. States) 130 (*Leskea fasciculosa*); Sull. & Lesq. Musc. Bor.-Am. (Ed. 1) 293, (Ed. 2) 432; Aust. Musc. Appal. 333.

Distinguished from the species by the julaceous branches, appressed-imbricate leaves, more obtuse and more decurrent.

Var. SCABRISETUM Grout, Bull. Torr. Bot. Club 25: 241. 1898.

Seta plainly scabrous with scattered papillae; otherwise like var. *praecox*.

On shaded ground.

Type in the Columbia Herbarium from the Palisades, N. J., Austin; Sargentsville, N. J., Best; Rensselaer Co., N. Y., E. C. Howe; Vineyard Haven, Mass., R. E. Schuh.

EXSICCATI: Grout, N. Am. Musc. Pl. 333.

In most sets of both editions of Sull. & Lesq. Musc. Bor.-Am. a portion of the specimen labeled *E.*

strigosum is smaller and has julaceous branches and in some sets of Ed. 1, a scabrous seta. This portion I should refer to var. *praecox* or var. *scabrisetum* as the case may be.

The roughening of the seta is a character not mentioned in any European work or observed in any European specimen, and is probably a new development.

As a rule the branch leaves of *E. fallax* are strongly decurrent, those of *E. strigosum praecox* and *E. diversifolium* somewhat so, while those of *E. strigosum* are usually not at all decurrent. The stem leaves of all these forms are more or less decurrent.

All the available literature on *E. strigosum*, *E. strigosum praecox* and *E. diversifolium* has been carefully studied to discover a satisfactory arrangement of the forms usually referred to these species. The result has been very unsatisfactory and the matter cannot be definitely settled until the types are compared with American material. The European material in the Herbarium of Columbia University indicates that the forms usually referred to *E. diversifolium* belong rather to *E. strigosum praecox* and accordingly this ground is taken provisionally. Limpricht's description of the variety *praecox* is copied and a full description of the American plant is given. Some discrepancies will be noted. Some of the American forms referred provisionally to var. *praecox* are more robust than any European material which has been examined. Limpricht says that the true *E. diversifolium* is a true alpine moss, "Ein echtes Hochalpenmoos," which the *E. diversifolium* of Lesq. & James and most other American authors is not.

In the mountainous and boreal regions of the northern United States and Canada west of the longitude of the Mississippi there is found an alpine moss which agrees very closely with Rabenhorst's Bryoth. Eur. No. 1143 (*E. diversifolium*), which is cited by Limpricht (l. c. 160). This western plant has been referred to *E. diversifolium*.

EURHYNCHIMUM FALLAX (R. & C.) Grout, Bull. Torr. Bot. Club 25: 242. May, 1898.

Eurhynchium strigosum var. *fallax* R. & C. Bot. Gaz. 14: 98. pl. 14, B. 1889.

Eurhynchium substrigosum Kindb. Macoun, Cat. Can. Pl. 6: 205. 1892.

Plants in loosely intricate mats, robust, green to light yellow-green; stems 5-10 cm. long, procumbent, arcuate, ascending, often stoloniferous and rooting at the ends, giving off several secondary stems that bear comparatively few branches, branching irregular to subpinnate; branches 7-15 mm. long, terete-foliate, attenuate; branch leaves erect-open, usually long-decurrent, cordate-ovate to lanceolate-lingulate, 0.8-1.2 × 0.4-0.55 mm., rounded-obtuse, serrate above, serrulate to the base, concave, usually slightly plicate when dry; costa extending about seven-eighths the length of the leaf, ending in a spine underneath; median leaf-cells linear, 9-12 : 1; quadrate alar cells numerous; apical cells of various shapes, oblong-elliptical, elliptical, and circular; stem leaves larger and more narrowed at apex, 1.2-1.5 × 0.5-0.8 mm., only the lower and those of the stoloniferous stems acute or long-acuminate; perichaetial leaves with oblong sheathing bases, very abruptly narrowed to filiform erect-spreading acumination, the inner with a long thin costa, serrulate or entire. Monoicous. Seta red-brown, smooth, twisted to the right; capsule brown, oblong, unsymmetric, horizontal; urn 2.5 × 1 mm., little constricted below the mouth when dry and empty; operculum conic, abruptly long-rostrate, beak two-thirds length of urn; annulus present, of at least two rows of cells; cilia stout, 2 or 3, nodose to subappendiculate; spores minutely roughened, 10-13 μ, maturing in winter.

Type locality, on old logs, Lake Pend d'Oreille, Idaho, Leiberg.

On the ground, roots of trees and decaying logs. Northern United States and Canada, in the Rocky Mountain region. Alaska, O. S. Bates; British Columbia, Macoun; Idaho, Sandberg and Leiberg; Montana, Watson; Colorado, Wolf and Rothrock.

ILLUSTRATIONS.—R. & C., l. c.; Pl. 4.

EXSICCATI.—R. & C. Musc. Am. Sept. Exsic. 116; Grout, N. Am. Musc. Pl. 83, 83a; Macoun, Can. Musc. 449, in the Columbia Herbarium as *E. substrigosum* Kindb., is not this species, but appears to be *E. strigosum robustum*. Authentic material of *E. substrigosum* has been examined.

Distinguished from *E. strigosum robustum* by the more diffuse straggling habit, more distant leaves, branch leaves broad and rounded at apex, and less acute stem leaves; from *E. strigosum* and its other varieties, and the other closely allied species it is easily distinguished by its greater size and looser habit.

Var. BARNESII (R. & C.) Grout, l. c.

Eurhynchium strigosum var. *Barnesii* R. & C. Bot. Gaz. 14: 98. 1889.

Stouter, with more slender, lingulate leaves which are also narrower at apex; capsule much larger and thicker.

Type locality the same as for the species.

Collected several times in Idaho by Sandberg and by Leiberg.

Var. TAYLORAE (Williams) Grout, Bryol. 5: 41, May, 1902.

Eurhynchium Taylorae Williams, Bull. Torr. Bot. Club 29: 66. 1902. pl. 4.

The extreme development in point of size of this extremely variable species. This form reaches nearly the size of *E. oreganum* but aside from size the leaf structure and form is not different from that figured by Cardot for *E. fallax*. The illustrations in Williams' plate illustrating the variety show the decurrent angles which are omitted in Cardot's drawings. The seta is very short and stout in the type.

Type, Leiberger's 172 from Traill River Basin, Idaho.
EXSICCATI.—The largest plants in my N. Am. Musc. Pl. 83a.

EURHYNCHIUM DIVERSIFOLIUM (Schleich.) Br. & Sch. Bry. Eur. fasc. 57-61, pl. 520. 1854.

Hypnum diversifolium Schleich. in Herb. and Catal. 1807. (In part), teste Limpricht.

Eurhynchium strigosum var. *diversifolium* Molendo & Lorentz, Flora. 1867.

Plants caespitose or in thick, densely intricate mats, green to yellow-green; stems 2-7 cm. long with long thick stolons, creeping, densely radiculose, sending up numerous fasciculately divided branches; branches short, 2-5 mm. long, julaceous, blunt; branch leaves appressed-imbricate, ovate, acute or rounded-obtuse, 0.5-0.6 × 0.36-0.45 mm., serrulate, concave, excavate at the slightly decurrent angles; costa extending four-fifths length of leaf, often ending in a spine underneath; median leaf-cells linear to linear-oblong, 5-8 : 1, apical rhomboidal or nearly circular; area of quadrate alar cells much larger than in any of the allied species; stem leaves ovate, acute to long-acuminate, decurrent, 0.8-1 × 0.6-0.75 mm.; leaf-cells narrower and longer, apical cells not differentiated; costa seldom ending in a spine; leaves of stoloniferous stems varying greatly in size on the different parts of the stolon, slightly open, without chlorophyll, elongated-triangular, narrowly long-acuminate; excavate at the angles, very long and narrowly decurrent; costa slender or wanting; perichaetial leaves sheathing at base, with spreading acumination, oblong-ovate, abruptly long-acuminate; costa thin or wanting. "Dioicous or pseudo-monoicous." Seta 5-10 mm. long, red-brown, smooth, twisted to the right; capsule red-brown, ovoid to short-oblong, unsymmetric and inclined; 1.5 : 1, slightly contracted under the mouth when dry; operculum long-rostrate, nearly as long as the urn; "annulus of two rows of cells, persistent"; segments from a basal membrane one-third the length of the teeth; cilia 2 or 3, appendiculate; spores finely roughened, 14-18 μ, maturing in winter.

Type locality, European. Type at Kew.

On the ground and rocks in mountainous and boreal regions of western North America, especially in the Rocky Mountain region. Ohio, *vide* Schimper, l. c.; S. Dakota, M. A. Thompson.

ILLUSTRATIONS.—Br. & Sch. l. c.; Limpricht, Rab. Krypt. Fl. 4³, f. 34; Pl. 4.

EXSICCATI.—Macoun, Can. Musc. 500; Grout, N. Am. Musc. Pl. 425, Musci Perfecti 83.

Limpricht, l. c., describes the branch leaves as round-obtuse with the costa seldom reaching three-fourths of the length of the leaf, but Rabenhorst's *Bryotheca Europea*, 1143, which he cites, agrees with the American material in these respects as well as in the dimensions of the leaf-cells. It seems pretty certain that our American plant here referred to *E. diversifolium* agrees with Limpricht's idea of this species and it certainly agrees with the accessible European exsiccati. While resembling *E. strigosum praecox* in many ways it can be readily distinguished by its slender habit, smaller branch leaves and more numerous quadrate alar cells.

EURHYNCHIUM PRAELONGUM (Dill. L.) Bryhn, Explor. Bryol. in Valle Norv. Stördalen, 59. 1893.
(*vide* Limpricht).

Hypnum praelongum L. Sp. Pl. 1125. 1753. (Non Hedw. St. Cr. 4: 76. f. 29. 1797.)

Eurhynchium pseudospeciosum Kindb. Can. Rec. Sci. 1894: 22. 1894.

Hypnum Royae Aust. Bot. Gaz. 3: 31. 1878.

Eurhynchium acutifolium Kindb. Rev. Bryol. 22: 84. 1895.

"Stems (in the type) slender, prostrate, elongated (2-5 inches), divided; at intervals rather regularly pinnate, with slender, somewhat attenuated, often curved, not very crowded, subcomplanate branches; forming low, somewhat straggling masses of a bright or dull green, less commonly yellowish. Stem-leaves distant or more rarely crowded, widely cordate-triangular or widely ovate-cordate, rapidly or even abruptly and longly acuminate in a long often almost filiform, squarrose acumen; at base wide, excavate, strongly decurrent; margin plane, regularly and distinctly denticulate, nerve slender, reaching above half-way and usually into the acumen; cells linear, slightly vermicular, tapering but obtuse, 10-18 times as long as wide, pellucid; towards base wider and shorter, lax, at angles large, subrectangular, but not forming clearly defined auricles. Paraphyllia occasionally, but not always present. Branch leaves much narrower, widely or even narrowly lanceolate, gradually acuminate, very acute, somewhat erect when dry, more spreading when moist, not complanate, moderately soft in texture and often twisted when dry, not plicate, hardly glossy. Perichaetial bracts squarrose, very longly acuminate. Seta rather long, often one inch. Capsule turgidly ovate, narrower when ripe and empty, horizontal, abruptly passing into the seta at base, rather large; lid subulate-rostrate, usually decurved, almost as long as the capsule. Dioicous."

The above excellent description is copied from Dixon and Jameson's Handbook of British Mosses, p. 416. The species is rare in America and Mr. Dixon has had a much better chance to become acquainted with it, as it is common in England.

Type locality European.

On soil and decayed stumps.

California, Bolander, no. 83; Olema, San Mateo Mts.; White Mts., N. H.; Oregon, Vancouver Island, Washington.

ILLUSTRATIONS.—Dixon & Jam. Handb. Brit. Mosses, pl. 54 A.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 433, (*Hypnum Stokesii*). Also sent out by Macoun as No. 100 of his Canadian Cryptograms under the name of *Eurhynchium pseudospeciosum*. Canadian Musci 442 (*E. hians* ?); Grout, N. Am. Musci Pl. 53. 167.

There has been an almost endless amount of confusion as to the nomenclature of this plant. Wilson, Mitten, Dixon and Lindberg have applied the name to one plant, and Hedwig, Schimper, Husnot, Limpricht, and Cardot to another. The plant of Lindberg and the British bryologists is very closely allied to *E. Stokesii*, indeed, the latter appears to be only a variety of it. The *E. praelongum* of Hedwig and Schimper is identical with our *E. hians*. Now the two species that have borne this name are utterly and entirely distinct and could not be confused by the veriest tyro. The decision as to what is the true *E. praelongum* must rest with the Dillenian plant on which Linnaeus founded *Hypnum praelongum*. Lindberg saw the plant in Dillenius' herbarium and declares that it is the plant that the British bryologists have called *E. praelongum*. As Lindberg was an acute observer and has the best possible grounds for his opinion, I have followed him. One reason for the continuance of the confusion is the fact that the true *E. praelongum* is rare on the continent and in America and when found has nearly always been referred to *E. Stokesii*.

E. praelongum is distinguished from its variety *Stokesii* by its less robust, more straggling appearance, less rigid stems, fewer paraphyllia and less regularly pinnate and less bipinnate branching. There is not the difference between the relative dimensions of the leaf-cells that is indicated by the two descriptions. I think Mr. Dixon's figures are too large. The leaves of the species are frequently more distant than those of the variety and the branches are much fewer in number.

Specimens of *Rhynchostegium Royae* (Austin) R. & C. collected in California by James and named by Austin, in the herbarium of the N. Y. Botanical Garden seem to be *E. praelongum* although they are too depauperate and scanty to make sure.

Var. *STOKESII* (Turn.) Dixon l. c.

Hypnum Stokesii Turn. Musc. Hiber. 159. pl. 15. f. 5. 1804.

Eurhynchium Stokesii Br. & Sch. Bryol. Eur. fasc. 57-61. pl. 526. 1854.

Plants in wide intricate mats, green to light yellowish green; stems rigid, procumbent, often stoloniferous, irregularly divided; 10-13 cm. long, sparingly radiculose, sending up suberect secondary stems which are closely and regularly pinnate, often bipinnate and 2-3 cm. long; branchlets slender, 3-13 mm. long, teretefoliate; branch leaves erect-open, decurrent, ovate-lanceolate, acuminate, 0.7-0.8 × 0.45 mm., smaller at the apex of the branches and on the smaller branchlets, serrate above, serrulate to the base; angles of the cell walls very slightly papillose-thickened; costa extending three-fourths length of leaf, often ending in a spine underneath; median cells oblong-linear, 5-8 : 1, broader and shorter at the decurrent angles; stem leaves distant, squarrose, strongly decurrent, triangular-ovate, abruptly and slenderly long-acuminate, 0.7-0.9 × 0.9-1.3 mm., serrate (entire on some of the stoloniferous portions), basal cells thicker walled, quadrate alar cells more numerous than in the branch leaves; paraphyllia borne sparingly on the stems (Dixon l. c. describes the paraphyllia as numerous), leaf-like, triangular-ovate to ovate-lanceolate: perichaetial leaves ovate with sheathing bases, abruptly narrowed to a long slender squarrose acumination, strongly dentate-serrate, ecostate. Dioicous. Seta 2-3 cm. long, red-brown, stout, twisted to the right, very rough with large blunt papillae; capsule oblong-ovoid, red-brown, slightly unsymmetric, horizontal, slightly contracted under the mouth when dry; urn about 2 mm. long, 1.5-2 : 1; operculum long-rostrate, nearly as long as urn; annulus large, easily detachable; segments nearly as long as the teeth; cilia 2 or 3, nodose; spores 10-14 μ, maturing in late autumn or early winter.

Type locality, Ireland.

On the ground and roots of trees, west of the Rocky Mountains in the northern United States and Canada, Idaho, Washington, Oregon, California, Vancouver Island, British Columbia. Apparently common within this range. Newfoundland (*vide* Cardot).

ILLUSTRATIONS.—Turner, l. c.; Br. & Sch. l. c.; Pl. 5.

EXSICCATI.—Macoun, Can. Musc. 297; R. & C. Musc. Am. Sept. Exsic. 119; Grout, N. Am. Musc. Pl. 110, 239; Musci Perfecti 30.

Our American plant is as a rule considerably stouter than the European and more regularly pinnate, varying towards *E. oregonum*, which is most certainly a derivative of it. One of the best characterized of these forms is

Var. *CALIFORNICUM* Grout, l. c.

Gametophyte with the habit of a *Thuidium*; stems 15-20 cm. long, closely and regularly pinnate, seldom stoloniferous, more robust throughout; leaves of the maximum size.

Type from California, Bolander no. 46. 1876. In the herbarium of Columbia University.

EURHYNCHIMUM BRITTONIAE Grout, Bull. Torr. Bot. Club 25: 248. May, 1898.

Plants in wide intricate mats, dark green; stems creeping, radiculose, 5-10 cm. long, sparingly divided; branching closely and regularly pinnate; branches 5-10 mm. long, terete-foliate; branch leaves open-erect, $0.7-0.9 \times 0.3-0.4$ mm., gradually long-acuminate, lanceolate to ovate-lanceolate, serrate to the base, slightly or not at all decurrent; leaf-cells oblong-linear, 5:1, alar quadrate; costa extending four-fifths the length of the leaf, often ending in a spine underneath; stem leaves deltoid-ovate, 1.8×1 mm., including the filiform acumination which is 0.5-0.8 mm. long, serrulate at base, nearly entire above, strongly excavate at the decurrent angles; quadrate and rhomboidal alar cells numerous; perichaetial leaves sheathing at base, ovate to oblong-ovate, with a long-filiform squarrose acumination, ecostate, distantly spinose-toothed on the margins above. Seta 1.5-2 cm. long, red-brown, twisted to the right, nearly or quite smooth; capsule oblong-cylindric, unsymmetric and horizontal; urn 1.5 mm. long, 2:1, contracted below the mouth when dry; operculum long-rostrate, at least two-thirds the length of the urn; annulus?, segments from a basal membrane which is at least two-thirds the height of the teeth; segments split between the articulations; cilia 2 or 3, strongly nodose; spores finely roughened, about 15μ .

Type from California, Bolander. Specimens of this species of Bolander's California collections are in the National Museum from "Little River (Mendocino Co.?) at the foot of pine tree, no. 332." Also in the herbarium of Mr. J. M. Holzinger as no. 530.

This species is very closely related to *E. praelongum californicum* and greatly resembles it in appearance but is easily distinguished by its nearly smooth seta and nearly entire stem leaves.

Named in honor of Mrs. E. G. Britton.

EURHYNCHIMUM OREGANUM (Sulliv.) Jaeger. & Sauerb. St. Gall. Nat. Gesell. 1876-77: 361. 1878.

Hypnum oreganum Sull. Mem. Am. Acad. 4: 172. 1849.

Plants in wide loose mats; yellow-green above, brownish green below the surface; stems procumbent, densely radiculose at points of contact with substratum, 6-25 cm. long; sparingly divided, closely and regularly pinnate, often bipinnate; branches 1.3-2.5 cm. long, terete-foliate, tapering; branch leaves open-erect, decurrent, broadly cordate-ovate, $1-1.5 \times .75-1$ mm., acuminate, sharply serrate above, serrulate to base, somewhat concave and slightly plicate; costa stout, extending nearly to base of acumination, ending in a spine at the back; median cells linear, about 7:1; extreme alar cells thick-walled, oblong to rhomboidal; stem leaves larger, reaching 2×1.3 mm., more broadly ovate, longer acuminate; dioicous; male branches abundant; perichaetial leaves sheathing at base with reflexed points, ovate to oblong-ovate, abruptly long and slenderly acuminate, ecostate, sharply dentate-serrate. Seta 2-2.5 cm. long, red-brown, twisted to the right, very rough with high blunt papillae; capsule lighter colored, horizontal to slightly drooping, unsymmetric, oblong-ovoid, 2-2.5 mm. long, 2:1, slightly contracted under the mouth when dry and deoperculate; operculum a little shorter than urn; annulus present, well developed, of at least two rows of cells, easily detachable; segments as long as the teeth, more or less split between the articulation; cilia 2-3, well developed, nodose to short-appendiculate; spores $15-20 \mu$, nearly smooth, maturing in winter.

On the ground, decaying logs and base of trees. California, Oregon, Washington, Vancouver Id., Idaho, British Columbia.

ILLUSTRATIONS.—Sulliv. Bot. Wilkes Expd. Musc. 16. pl. 13, B; Pl. 5.

EXSICCATI.—Sull. & Lesq. Musc. Bor.-Am. (Ed. 2) 434; Macoun, Can. Musc. 298; R. & C., Musc. Am. Sept. Exsic. 120; Grout, N. Am. Musc. Pl. 5.

A beautiful species, closely allied to *E. Stokesii*; easily distinguished from that and other species by its large size and regularly pinnate branching.

EURHYNCHIMUM RUSCIFORME (Neck.) Milde Bryol. Siles. 312. 1869.

Hypnum rusciforme Neck. Delic. Gall.-Belg. 2: 481. 1768.

Rhychoslegium rusciforme Br. & Sch. Bry. Eur. fasc. 49-58. pl. 9. 1852.

Platyhypnidium rusciforme Fleisch. Laubmfl. Java 4: 1537. 1922.

Plants in large robust tufts, usually dark green, dirty green or almost black below; stems prostrate, woody, often very long and denuded of leaves; branches suberect in most cases, or more nearly straight and parallel with the stem, rigid and harsh to the touch when dry; leaves open-erect when dry, scarcely decurrent, reaching 2.4 by 1 mm., broadly ovate, slightly concave with plane margins, acute to almost obtuse, denticulate nearly to the base; costa very thick at base, reaching one-half to three-fourths the length of the leaf,

often ending in a spine at back; median cells linear, 8-15 : 1, rather thick-walled, at base and apex shorter. Seta smooth; capsule light to dark brown, oblong-ovoid, somewhat contracted under the mouth when dry; beak long and slender, often curved; spores maturing from August 15 to October 15.

ILLUSTRATIONS.—Bry. Eur. 1. c.; M. H. M. 293.

EXSICCATI.—Sull. Musc. Allegh. 46, 47 (as *Hyp. riparoides* and var.); Sull. & Lesq. Musc. Bor. Am. 297; Aust. Musc. Appal. 347; Macoun, Can. Musc. 301, 326 and 482, 659 as varieties; Grout, N. Am. Musc. Pl. 39; Musci Perfecti 123.

Very common in brooks, especially in elevated regions, either submerged or on rocks wet by spray and submerged only during high water. As this species fruits freely it is easily determined if collected in the autumn. In gross appearance it resembles *Hypnum dilatatum* somewhat, but the costate leaves, which are not nearly so orbicular, and the long-rostrate operculum render it easy to distinguish between them. There is a wide range of variation in size and acumination of leaves, the apex sometimes being much more slender than figured. The habit of the plant is also variable, ranging from the form figured to soft slender almost floating forms.

When I wrote my monograph on Eurhynchium (Bull. Torr. Bot. Club, May, 1898), I hesitated about including Rhynchostegium, but after a longer acquaintance and more complete study I can see no reason whatever for a separate genus. Certainly as far as American forms are concerned the distinctions between Eurhynchium and Rhynchostegium are very hard to find and still harder to define.

EURHYNCHIUM SERRULATUM (Hedw.) Kindb. Can. Rec. Sci. 1894: 22. 1894.

Hypnum serrulatum Hedw. Spec. Musc. 238. pl. 60. 1801.

Rhynchostegium serrulatum Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 370. 1878.

Plants growing in wide loose thin mats over humus in woods, chlorophyll green, scarcely glossy, flattened, with the appearance of a Plagiothecium; branch leaves distant, about 2 mm. long, plane margined, serrate, slightly concave, somewhat contorted when dry but scarcely striate or plicate, ovate-lanceolate, long-acuminate, strongly serrulate above; median cells linear-vermicular, 7-10 : 1, basal and alar somewhat broader and shorter, no specially differentiated alar cells; costa rather thin, usually reaching well above the middle of the leaf, sometimes shorter; stem leaves cordate-triangular, more abruptly and narrowly acuminate with a much more slender point, slightly serrulate above; alar cells more differentiated; seta smooth; capsules contracted under the mouth when dry and empty, urn about 2 mm. long, operculum long and narrowly beaked; spores maturing from September 1 to October 15.

ILLUSTRATIONS.—Sull. Icones Musc. pl. 107; M. H. M. 294.

EXSICCATI.—Sull. Musc. Allegh. 57; Sull. & Lesq. Musc. Bor. Am. 436; Drumm. Musc. Am. (S. States) 118; Aust. Musc. Appal. 346; Macoun, Can. Musc. 456; Grout, N. Am. Musc. Pl. 152.

Frequent but almost sure to be mistaken for a Plagiothecium, unless in fruit or studied microscopically. Sterile it might be mistaken for *B. Starkei* or *B. rutabulum*. From the former it differs in the narrower leaves with the alar cells of its stem leaves much less conspicuous. From certain forms of the latter it would be well-nigh indistinguishable without the sporophyte. When the sporophyte is present, the smooth seta and the small *lighter colored* capsule afford a ready means of distinction even if the operculum has fallen.

DOUBTFUL SPECIES.

EURHYNCHIUM DAWSONII Kindb. Bull. Torr. Bot. Club, 17: 278. 1890.

Plants in thin intricate mats, dirty green, branches tipped with bright somewhat glossy green leaves; branch leaves loosely intricate, slightly or not at all decurrent, ovate, more or less long-acuminate, concave, serrulate above, margins slightly reflexed at base, 1-1.2 × 0.5 mm.; costa very stout, extending four-fifths length of leaf; median cells oblong-linear, 6-8 : 1; area of quadrate alar cells large. Sporophyte not seen.

Described from a specimen bearing this label, "On stones in ditch west side of Black's Hotel, Hastings, B. C., April 29, 1889."

Resembling *E. crassinervum* in the stout costa, broad leaf-cells and numerous quadrate alar cells; differing in the slender habit and smaller ovate branch leaves.

The following is the original description:

"Stems densely pinnate, not or rarely radiculose; branchlets patent. Leaves green or brownish, not glossy, not or indistinctly papillose, not long-acuminate from the broad ovate base, recurved on the borders below, long-decurrent, open-erect, denticulate all around, areolation variable, often sub-rhomboidal; costa thick, reaching nearly to the apex. Probably dioicous."

"Allied to *E. hians* and *E. Sullivantii*."

"On rocks along the Nanaimo River below the railway bridge, Nanaimo, Vancouver Island, April 27, 1887."

EURHYNCHIUM CRASSINERVUM (Tayl.) Br. & Sch. var. *LAXORETE* Kindb. Macoun, Cat. Can. Pl. 6: 207. 1892.

"Differs in the leaves being nearly entire or faintly denticulate above, shorter acuminate and the cells larger. Only male flowers found."

"On earth in woods at Canaan Forks, Queen's county, New Brunswick. J. Moser."

No specimens available and original description quoted.

RHYNCHOSTEGIELLA (Br. & Sch.) Limpr. Laubm. 3: 207. 1896.

Small mosses of damp places. Distinguished from *Eurhynchium* by the diminutive size of both gametophyte and sporophyte.

RHYNCHOSTEGIELLA CURVISETA (Brid.) Limpr. l. c., 211. Dec. 1896.

Hypnum curvisetum Brid. Spec. Musc. 2: 111. 1812.

Plants very slender; leaves lanceolate, long-acuminate, costate to the middle, concave, serrate at apex, 1-1.2 mm. long by 0.24-0.30 mm. wide; median leaf cells linear, 8-10 : 1, a few basal shorter and broader. Monoicous. Seta 5-8 mm. long, rough; capsule about 1 mm. long; operculum rostrate; spores in winter.

The above description has been adapted from Limpricht. No American sporophytes have been seen and it is possible that none have been found. James' specimens have leaves 1.5 mm. long with the acumination $\frac{1}{3}$ of this. The median leaf cells reach 50 μ long by 4 μ wide and the lower leaf margins are slightly recurved yet they seem too close to the European plant to be considered a separate species. The only other collection that I have found besides that at Fairmount Park, Philadelphia, is one by Andrews in North Carolina. I am hazarding the guess that the plant rarely fruits in America and is so small that it is overlooked or discarded as trash.

ILLUSTRATION.—Bry. Eur. pl. 509 (as *Rhynchostegium Teesdalei*). Pl. 14.

CIRRIPHYLLUM Bull. Torr. Bot. Club 25: 222. May, 1898.

Plants very robust, glossy, growing on earth and rocks, occasionally on roots of trees; stems possessing a well differentiated central strand, prostrate or creeping, irregularly or subpinnately branching, branches julaceous, terete-foliate. Leaves imbricate, *very concave, spoon-shaped, rounded and often cucullate at apex, abruptly drawn out into a long filiform acumination*, costate to the middle or beyond; median leaf-cells linear, 10-15 : 1; basal broader and shorter; alar often quadrate. *Sporophyte* as in *Brachythecium* except that the operculum is usually long-rostrate.

The plants referred to this genus certainly have no closer genetic relationship with those retained to represent *Eurhynchium* than with several other genera. The rostrate operculum is the only character which would link the two in one genus. Lindberg transferred the European representatives of this genus to the division *Rhynchostegium* of the genus *Hypnum*, while Kindberg places them all in *Brachythecium*. The gametophyte characters of several species are certainly more like *Brachythecium* than *Eurhynchium*. The resemblance between *C. Tommasinii* and *Brachythecium albicans* is certainly very striking, and robust forms of the latter have been taken for the former. Consequently it seems far more satisfactory to constitute the following species a separate genus, far better characterized than many of the allied genera, also more distinct and more homogeneous.

KEY.

- | | |
|---|-------------------------------|
| 1. Leaves with a very long filiform acumination..... | 2. |
| Leaves shorter acuminate, apex twisted..... | <i>Boscii</i> . |
| 2. Apex of branch leaves strongly cucullate at base of the acumination..... | 3. |
| Apex of branch leaves not cucullate at base of acumination..... | 4. |
| 3. High alpine mosses growing on stones; costa of stem leaves very short..... | <i>cirrosum</i> . |
| Lowland mosses growing on the ground and roots of trees; costa of stem leaves extending $\frac{2}{3}$ their length..... | <i>piliiferum</i> . |
| 4. Acumination 0.3-0.4 mm. long; median leaf-cells 3-4 : 1..... | <i>Brandegei</i> . |
| Acumination 0.5-0.8 mm. long; median leaf-cells 8-12 : 1..... | <i>cirrosum coloradense</i> . |

CIRRIPHYLLUM CIRROSUM (Schwaegr.) Grout, l. c. 223.

Hypnum cirrosum Schwaegr. Schulte's Reise auf d. Glockner, 365. 1804.

Brachythecium cirrosum Schimp. Syn. Ed. 1: 696. 1860.

Eurhynchium Vaucheri var. *julaceum* Br. & Sch. Bryol. Eur. fasc. 57-67, pl. 530. 1854.

Myurium (?) *Herjedalicum* Schimp. Syn. Musc. 696. 1860 (fide Juratzka).

Eurhynchium cirrosum Husnot, Musc. Gall. 338. 1893.

Plants in bright glossy yellow-green mats; primary stems creeping, irregularly branching; branches 5-10 mm. long, julaceous; branch leaves appressed-imbricate, decurrent, oblong-ovate, not including acumination 1.3×0.65 mm., entire or serrulate above, abruptly narrowed to a filiform acumination (which is serrulate to nearly entire, 0.5 mm. long), concave and spoon-shaped, cucullate at base of acumination; margins somewhat reflexed below; costa short, extending from $\frac{1}{8}$ - $\frac{1}{2}$ length of leaf, sometimes divided or branching; median cells 10-12: 1; alar quadrate to hexagonal, indistinct; stem leaves ovate, body of leaf 1.8-2.4 mm., acumination 0.6-1 mm. long, area of quadrate-hexagonal alar cells much larger; costa very short, median leaf-cells somewhat shorter; perichaetial leaves ecostate, serrate at apex, abruptly narrowed into a long-filiform squarrose serrate acumination. Dioicous. Seta 15 mm. long, twisted to the right, rough with blunt papillae; capsule ovoid, unsymmetric, horizontal, with operculum 2 mm. long, 2-1, chestnut-brown, not contracted under the mouth when dry; operculum sharply conical, not rostrate; annulus* not highly differentiated, segments split between the articulations; cilia 2, strongly nodose; spores 18-20 μ , finely roughened.

Description of sporophyte adapted from Limpricht, Rab. Krypt. Fl. 4^s: 183. 1897.

Growing on rocks in mountains. Colorado; Pike's Peak; Skagway, Alaska, with capsules, Williams. Type locality, European.

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, Musc. Gall. pl. 97; Limpricht, Rab. Krypt. Fl. 4^s: f. 386; Dixon & Jameson Handb. Brit. Mosses, Pl. 53, f. G; Pl. 6.

Our American specimens are less robust and shorter stemmed than most of the European material at hand and the stems are not stoloniferous or the branches flagelliform as is usually the case with European specimens, yet some European plants agree almost exactly with the American plant and the two are almost certainly the same species. *C. cirrosum* is a very variable and poorly understood plant even in Europe.

Var. COLORADENSE (Aust.) Grout, l. c., 224.

Hypnum coloradense Aust. Bot. Gaz. 2: 111. 1877.

Plants robust; stems 3-5 cm. long, erect or at length prostrate, sparingly branched; leaves loosely imbricate, oblong-ovate, $2-2.2 \times 0.9$ mm. without the acumination, which is 0.5-0.8 mm. long, nearly entire, abruptly long-filiform acuminate but not at all cucullate, much less concave than in the typical form, somewhat plicate.

Type locality, Alma, Park Co., Colorado, Miss H. J. Biddlecome. Type in the herbarium of Columbia University.

Distinguished by the stout, sparingly branched stems and loosely imbricate leaves which are not cucullate at apex. It does not correspond with any of the European varieties mentioned by Limpricht so far as can be determined from the material at hand. It is clear that Austin did not know the true *cirrosum* for there is a specimen of it from Colorado labelled in Austin's handwriting, "*Hypnum coloradense* var. *dimidio minus, sericeo-aureo viride, caule subjulaceo tereti*."

CIRRIPHYLLUM BRANDEGEI (Aust.) Grout, l. c. 224.

Hypnum Brandegei Aust. Bot. Gaz. 3: 31. 1878.

Plants densely caespitose, yellow-green; stems erect, 3-4 cm. high, nearly simple, terete-foliate, obtuse; leaves loosely appressed-imbricate, not decurrent, ovate, abruptly subulate-acuminate to filiform-acuminate, 2×0.9 mm. (acumination 0.3-0.4 mm. long) entire, concave, plicate; margins plane; costa reaching the middle of leaf, sometimes forking; median cells oblong-linear, $25-30 \times 9 \mu$; basal cells shorter and broader; alar enlarged-quadrate. Sporophyte unknown.

Type locality, Colorado, Brandegee. Type in the Columbia University Herbarium.

Easily distinguished from *C. cirrosum* by its caespitose habit, short entire acumen and much looser areolation.

* Mrs. Britton, March, 1897, in specimens collected in Algau by Molendo (Herb. Jaeger), found the annulus to consist of 3 rows of very irregular and persistent cells.

CIRRIPHYLLUM PILIFERUM (Schreb.) Grout, l. c., 225.

Hypnum piliferum Schreb. Spicil. Flor. Lips. 91. 1771.

Eurhynchium piliferum Br. & Sch. Bryol. Eur. fasc. 57-61, pl. 531. 1854.

Plants in wide loose mats, glossy, bright yellowish-green; stems long, sometimes reaching 20 cm., creeping, irregularly divided, pinnately branching, sparingly radiculose; branches rather distant, 10-15 mm. long, terete-foliate; branch leaves loosely erect, imbricate, decurrent, ovate, very concave and spoon-shaped, the rounded apex abruptly narrowed into a long-filiform acumination, 1.2×0.8 mm., smaller near ends of branches; acumination one-half length of the body of leaf; apex cucullate, margins strongly serrate, more nearly or quite entire at base; costa fully two-thirds length of body of leaf; median leaf-cells linear, $10-15 \times 1$; alar cells abruptly enlarged and inflated; stem leaves larger and more broadly ovate, $1.5-2 \times 1$ mm. ($2-2.5 \times 1-1.2$ mm. according to Limpricht), enlarged and inflated alar cells more numerous: perichaetium sheathing, the leaves ovate, somewhat abruptly narrowed to a very long slender erect-spreading acumination, somewhat serrulate, ecostate or some of the inner slightly costate. Dioicous; male plants somewhat smaller. Seta 2-3 cm. long, dark red-brown, twisted to the right, very rough with low blunt papillae; capsule red-brown, inclined to horizontal, oblong-ovoid, arcuate; urn 2.5 mm. long, 2-3 : 1; operculum nearly as long as the urn, long-rostrate from a conic base; annulus of at least two rows of cells, detachable; teeth of peristome very slender-pointed, very strongly papillose-roughened above; segments nearly or quite as long as the teeth, slender, split between the articulations; cilia 2 or 3, long and very slender, nodose to subappendiculate; spores smooth, $12-16 \mu$, maturing in winter or early spring; sporophyte rare.

Type locality, European.

On the ground and base of trees in woods and shady meadows, most frequently on steep springy shaded banks of rivulets, often closely interwoven with other mosses; New Brunswick, New Hampshire, Vermont, New York, New Jersey, Pennsylvania, Ohio, Washington.

ILLUSTRATIONS.—Br. & Sch. l. c.; Hedw. Musc. Frond. 4: 35, pl. 14, 1794; Husnot, Musc. Gall. pl. 97; Dixon & Jam. Handb. Brit. Mosses, pl. 53, f. K; Pl. 6.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 290^b, (Ed. 2) 492; Austin, Musc. Appal. 336; Grout, N. Am. Musc. Pl. 120.

Infrequent or else overlooked because of its sterility.

Our American plant is much less robust than the European.

Cirriphyllum Tommasinii (Sendt.) Grout l. c. (*Hypnum Vaucheri* Schimp. not Lesq.) has been several times reported from America but I have been unable to find any American specimens of this species in any of the herbaria seen. *Brachythecium albicans* has been reported as this species and very likely forms of *C. cirrosus* may have been referred here.

CIRRIPHYLLUM BOSCHII (Schwaegr.) Grout, l. c. 226.

Hypnum Boschii Schwaegr. Suppl. 1: 223. 1816.

Hypnum illecebrum Hedw. Spec. Musc. 252. pl. 66 (excl. varieties). 1806.

Eurhynchium Boschii Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 361. 1878.

Myurium Boschii Kindb. Can. Rec. Sci. 1894: 73. 1894.

Plants in thick soft loosely intricate cushions, or in loose thin mats, on the ground among the grass, glossy, golden-yellow to brownish-yellow; stems creeping or ascending, irregularly divided and branching; branches and shorter stems suberect, turgid, terete-foliate; stems often stoloniferous and subpinnately branching, sparingly radiculose, 5-15 cm. long; branches 1-3 cm. long, the longer more or less subdivided; branch leaves erect-open when moist, loosely imbricate when dry, decurrent, scarious, broadly ovate, very concave, spoon-shaped, $2-2.5 \times 1.4$ mm., serrate to the middle; apex rounded and abruptly acuminate, acumination twisted one-half turn to the right; basal angles rounded, subauriculate; costa extending three-fourths length of leaf; leaf-cells thick-walled, the median linear, $6-10 : 1$, basal and apical shorter and broader, the alar not differentiated; leaves of the stoloniferous stems much smaller, less abruptly narrowed to the longer acumination, costa shorter; stem leaves less concave, less abruptly acuminate, acumination longer, less frequently twisted: apparently dioicous, male branches not seen; perichaetial leaves with oblong-ovate sheathing bases, abruptly narrowed to a filiform spreading acumination, ecostate and entire or toothed below base of acumination. Seta 1.5-3 cm. long, red to red-brown, smooth, slightly twisted to the right; capsule brown, inclined, unsymmetric to arcuate, gradually narrowed into the seta, oblong, strongly arcuate and contracted under the mouth when dry, with operculum $3-4 \times 1$ mm.; annulus of at least two rows of

cells; operculum conic, long-rostrate, about one-half the length of urn; segments as long as the teeth, split between the articulations; cilia 2 or 3, well developed, nodose; spores nearly smooth, 16μ , maturing in autumn.

Type locality, North America; collected by Bosc, probably in South Carolina. Type in the Boissier Herbarium at Geneva.

On the ground and rocks in shady places and open fields. Vermont to Florida and Louisiana, west to Missouri and Illinois; more abundant southward. The only specimen I have seen from Canada was of Drummond's collection and was in Prof. Macoun's collection as from "Upper Canada." Prof. Macoun suggests that it may have been from Niagara Falls.

ILLUSTRATIONS.—Sull. Icon. Musc. pl. 106. M. H. M. 295.

EXSICCATI.—Drumm. Musc. Am. (S. States), 132; Sulliv. Musc. Allegh. 42; Sulliv. & Lesq. Musc. Bor. Am. (Ed. 2) 435, (Ed. 1) 294; Austin, Musc. Appal. 331; R. & C. Musc. Am. Sept. Exsic. 117; Grout, N. Am. Musc. Pl. 352; Musci Perfecti 24.

A very striking and easily identified moss, but one which is unique in many respects and whose relationships are obscure.

The relationship of *Hypnum Boscii* to the other species referred to *Cirriphyllum* is somewhat less marked than the relationship between the other species of that genus, but it is closer than the relationship between *H. Boscii* and any other genus known to the author.

CHAMBERLAINIA nov. gen.

(In honor of the late Edward B. Chamberlain.)

Resembling the salebrosus group of *Brachythecium*. Differing in the erect symmetric and cylindrical capsules; also in lacking cilia in the peristome. The area of quadrate alar cells is rather larger and these cells rather more clear. *Brachythecium splendens* is an intermediate form but as it has a well-developed cilium, it is left in *Brachythecium*.

KEY.

- | | |
|---|-----------------------|
| 1. Plants as robust as <i>Brachythecium oxycladon</i> , and much resembling it when sterile.... | <i>acuminatum</i> . |
| Plants more slender..... | 2. |
| 2. Median leaf cells of branch leaves 4-8 : 1..... | <i>cyrtophyllum</i> . |
| Median leaf cells of branch leaves 10-13 : 1..... | <i>biventreosum</i> . |

CHAMBERLAINIA ACUMINATA (Hedw.) n. comb.

Brachythecium acuminatum (Hedw.) Kindb. Can. Rec. Sci. 1894: 72. 1894.

Leskea acuminata Hedw. Sp. Musc. 224. pl. 56. 1801.

Leskea setosa Hedw. Sp. Musc. 226. pl. 57. 1801.

Leskea Beyrichii Hampe., Linnaea, 13: 47. 1839.

Hypnum acuminatum C. Muell. Syn. 2: 334. 1851.

Hypnum erectum Drumm. Musc. Am. 224.

Homalothecium acuminatum Jaeger & Sauerb. St. Gall. Nat. Gesell. 1877-1878: 309.

Plants in wide, rather densely caespitose tufts, green to glossy yellow-green; stems creeping, radiculose, primary branches erect or ascending, 1-3 cm. long, sparingly divided, somewhat radiculose, often with radiculose tips; branchlets unequal, tapering, subjulaceous, terete-foliate; branch leaves erect-imbricated, open, appressed when dry, lanceolate to ovate-lanceolate, somewhat decurrent, $1-1.6 \times 0.4-0.6$ mm., acuminate, more or less serrate above, concave, somewhat plicate; margins often somewhat revolute; costa extending above middle; median cells linear to oblong-rhomboidal, 5-9 : 1; marginal cells broader; basal enlarged, quadrate; leaves of main branches deltoid ovate, broader: dioicous; male branches borne on the stem, gemmiform; perichaetium 2-2.5 mm. long; leaves loosely erect, the inner ovate-lanceolate to oblong-lanceolate, long-filiform acuminate, distantly dentate above, costate nearly to middle. Seta 1.5-2 cm. high, red-brown, smooth; capsule brown, cylindric, erect or very slightly curved, varying greatly in size, 1.5-3 mm. long; operculum conic to short-rostrate; annulus none; teeth of peristome united at base, lanceolate, with slender hyaline papillose-roughened points, red-brown below, margined; segments linear-lanceolate from a narrow basal membrane, slightly papillose-roughened above, about the length of the teeth; cilia very rudimentary or none; spores minutely roughened, 12-16 μ , maturing in autumn.

Type locality, Lancaster, Pa. (Muhlenberg).

On decaying wood, bases of trees, rocks and earth, in woods or shady places. Eastern North America, west to Minnesota, south to the Gulf; not rare.

ILLUSTRATIONS.—Sull. Icon. Musc. pl. 116; M. H. M. 284.

EXSICCATI.—Drumm. Musc. Am. (S. States) 124 (*Leskea setosa* var.); 125 (*L. setosa*), 126 (*L. acuminata*); Sull. Musc. Allegh. 72; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 330, (Ed. 2) 491, 492 and 493; Austin, Musc. Appal. 310; Macoun, Can. Musc. 282; Grout, N. Am. Musc. Pl. 116.

This species is very variable in width of basal membrane, width of segments, shape of leaves and length of acumination, but no one of these variations seems to be correlated with any other.

Hedwig's type has lanceolate branch leaves, becoming broadly lanceolate below; basal membrane of medium width; the plants are small and slender, leaves serrulate above and more contracted at base than usual. The form ordinarily distributed as the species corresponds to Hedwig's *setosa*, but the two cannot be distinguished except as extreme forms of one species. The leaf of *acuminata* figured by Hedwig must be a stem leaf, as the branch leaves of his type are lanceolate.

Var. *RUPINCOLA* (Sull. and Lesq.) n. comb.

Hypnum acuminatum rupincolum Sull. and Lesq. Mosses of North America, 336. 1884.

Leskea rupincola Hedw. Sp. Musc. 227. pl. 54.

Characterized by an extremely narrow basal membrane. Probably having the range of the species but found most frequently in the southeastern United States.

Var. *FILIFORME* E. G. Britton, Mem. Torr. Bot. Club, 4: 185. 1893, is not a Brachythecium.

CHAMBERLAINIA CYRTOPHYLLA (Kindb.) n. comb.

Brachythecium cyrtophyllum Kindb. Ottawa Nat. 4: 63. 1890.

Plants caespitose; tufts glossy-green, usually densely intricate; stems irregularly divided and branching; branches filiform, subjulaceous, 5-10 mm. long; branch leaves open-erect, appressed-imbricate when dry, ovate to ovate-lanceolate, acute or short acuminate, 0.7×0.3 mm., serrulate, very concave; margins reflexed below; costa extending $\frac{2}{3}$ - $\frac{3}{4}$ length of leaf; median cells fusiform, 4-8 : 1; many basal cells shorter and broader; quadrate alar cells numerous; stem leaves broadly ovate, acuminate, 0.7×0.4 mm.; median leaf-cells 3-5 : 1. Dioicous. Seta and capsule much as in *C. acuminata* but the capsule narrower, peristome similar.

Type locality, Brighton, Northumberland Co., Ontario, October 6, 1888 (Macoun). Type seen.

Roots of trees and old logs. Waterloo, N. Y., Austin, 602; *Hypnum* (*Brachythecium*) *julaceum* sp. nov. (Ms. notes in Austin's herbarium.) Frequent in the North Central States, south to N. Carolina.

EXSICCATI.—Aust. Musc. Appal. 311 (*Brachythecium acuminatum* var. *setosum*); Grout, N. Am. Musc. Pl. 115, 359.

ILLUSTRATION.—M. H. M. 285.

Closely allied to *B. acuminatum*, distinguished by its filiform stems and branches and small leaves with shorter cells.

CHAMBERLAINIA BIVENTROSA (C. Muell.) n. comb.

Brachythecium biventreosum C. Muell. Bull. Torr. Club 5: 49. 1874.

Plants loosely caespitose, light-green, small and slender; stems creeping, subpinnately branching; branches slender, 3-8 mm. long, julaceous, terete-foliate; branch leaves appressed-imbricate, lanceolate to narrowly ovate-lanceolate, gradually narrowed to a long slender point, serrulate with small distant teeth, concave with margins recurved or biscalculate at base; costa extending $\frac{2}{3}$ the length of the leaf; median cells linear, 10-13 : 1; basal cells shorter and broader; alar quadrate, indistinct; inner perichaetial leaves sheathing at base, more or less abruptly narrowed into a filiform reflexed acumination, dentate above, ecostate. Dioicous. Seta 10-15 mm. long, red-brown, smooth; capsule red-brown, oblong, about 1.8 mm. long and less than half as thick, erect and symmetric; operculum conic, apiculate; annulus lacking; segments of peristome attached to a narrow basal membrane, split between the articulations; cilia single, rudimentary.

Type specimen on trunks and roots of trees in woods near Baton Rouge, La. (Dr. Joor). (Type seen; specimens examined by Mueller were communicated to the Columbia Herbarium by Dr. Mohr.)

C. biventreosa is closely allied to *C. acuminata*, from which it is distinguished by its smaller size and by its very narrowly pointed leaves with fewer and indistinct alar cells.

BRACHYTHECIUM Br. & Sch. Bryol. Eur. 1851.

Plants mostly of medium size and typically hypnaceous habit, very rarely pinnately branching with any degree of regularity. Branch leaves acute to acuminate, never obtuse, usually somewhat concave and often plicate or sulcate, costate to above the middle; median leaf cells sinuous-linear to linear-rhomboidal (broader and shorter in *B. reflexum*, *B. digastrum* and in some leaves of *B. cyrtophyllum*), basal cells broader and shorter, alar quadrate, rarely inflated and hyaline.

Stem leaves notably different in most species, larger and proportionately broader, often more slenderly acuminate and less strongly serrate; seta smooth to very rough, twisted to the right, capsules short-ovoid to oblong-ovoid, cernuous-arcuate and 2-4 : 1 (cylindric in *B. oxycladon* and nearly erect and symmetric in *B. splendens*), slightly contracted under the mouth when dry and empty; operculum conic to short rostrate; peristome characteristically hypnaceous and perfect. When in fruit this genus is easily recognized in most cases by the short, thick, dark-colored capsules, which are usually unsymmetric and horizontal; spores almost without exception maturing in late autumn or early winter.

The grouping of species given below is a little different from that given in my monograph of the genus, in Vol. VI of the Memoirs of the Torrey Botanical Club, but represents opinions based on a great deal of additional study.

(1) The Salebrosum group consisting of *B. salebrosum*, *B. flexicaule*, *B. acutum*, *B. campestre*, *B. oxycladon*, *B. digastrum*, *B. albicans*, *B. pseudocollinum*, *B. turgidum*, *B. glareosum*, *B. Wootonii*, *B. beringianum*, *B. edentatum* (?), *B. Roteanum* and *B. splendens*.

This group is characterized by smooth seta (except *B. campestre*), leaves plicate or sulcate when dry (except *B. acutum*), slenderly acuminate, concave and excavate at basal angles with the margins turned back parallel to the plane of the leaf (or reflexed in the ordinary descriptive language) in the lower portion; basal cells broader and shorter, quadrate alar cells numerous, hyaline or slightly chlorophyllose, stem leaves ovate-lanceolate; annulus poorly developed, fairly well developed in *B. acutum*.

(2) The Rutabulum group including *B. rutabulum*, *B. rivulare*, *B. Washingtonianum*, *B. asperrimum*, *B. lamprochryseum* and *B. Nelsoni*, characterized by rough setae, well-developed annulus, ovate-deltoid stem-leaves with leaves less concave and alar cells less numerous, except in *B. rivulare* and *B. Nelsoni*.

(3) Reflexum group including *B. reflexum*, *B. glaciale*, *B. Starkei* and *B. pacificum* characterized by triangular-ovate decurrent leaves which are not plicate.

(4) The Plumosum group including *B. plumosum* and *B. populeum*, characterized by rough setae and densely chlorophyllose quadrate alar cells.

(5) The Velutinum group including *B. velutinum*, *B. erythrorrhizon*, *B. Thedinii*, *B. Leibergii*, *B. collinum*, *B. utahense*, *B. Bolanderi* and *B. petrophilum*, characterized by small size and in our species by somewhat second leaves.

KEY.

- | | |
|---|--------------------|
| 1. Costa extending to the apex in most leaves | 2. |
| Costa ending below apex | 4. |
| 2. Seta very rough throughout | 3. |
| Seta rough above only | <i>populeum</i> . |
| 3. Plants very slender; leaf cells 3-5 : 1 | <i>reflexum</i> . |
| Plants more robust; leaf cells 8-10 : 1 | <i>Beslii</i> . |
| 4. Branch leaves entire* | 5. |
| Branch leaves serrulate to strongly serrate | 6. |
| 5. Slender; mostly dioicous | 32. |
| Very stout; leaves loosely appressed-imbricate; monoicous | <i>turgidum</i> . |
| 6. Seta smooth throughout | 7. |
| Seta more or less roughened with papillae | 17. |
| 7. Capsules erect and symmetric | 8. |
| Capsules more or less unsymmetric and cernuous; cilia well developed | 9. |
| 8. Southern. Capsules 3 mm. long; cilia single, well developed | <i>splendens</i> . |
| Northwestern. Capsules not more than 2 mm. long; cilia rudimentary or wanting | <i>utahense</i> . |

* *B. acutum* and *B. plumosum* often have some of the branch leaves entire.

9. Capsules 3-4 : 1, cylindric, suberect. (See *digastrum*.) 10.
 Capsules 2-3 : 1, strongly unsymmetric and cernuous. 11.
10. Enlarged basal and alar cells numerous, quadrate to oblong-hexagonal; monoicous. Southern. *Roteanum*.
 Quadrate alar cells less numerous and smaller; dioicous. Northern. *oxycladon*.
11. Stem leaves gradually and evenly narrowed from base to slender apex. 12.
 Stem leaves acuminate, i. e. less rapidly narrowed near apex than below. 14.
12. Plants robust; stem leaves at least 1.8 mm. long. 13.
 Plants more slender; stem leaves seldom more than 1.5 mm. long. *pseudocollinum*.
13. Stem leaves lanceolate, 0.6 mm. broad. *flexicaule*.
 Stem leaves slenderly triangular-ovate. *acutum*.
14. Branch leaves mostly more than 1.5 mm. long. 15.
 *Branch leaves mostly 1 mm. long or less. 16.
15. Dioicous; western or subalpine. 31.
 Monoicous; common, rare west of the Great Plains; leaves not falcate-secund. . . *salebrosum*.
16. Stem leaves broadly ovate; plants robust. *digastrum*.
 Stem leaves ovate-lanceolate; plants slender. *collinum*.
17. Seta slightly roughened with small or distant papillae. 18.
 Seta rough above, nearly smooth below. 19.
 Seta roughened throughout with large papillae†. 20.
18. Stems short, irregularly branching; monoicous. *collinum*.
 Stems long and slender, pinnately branching; dioicous. *Theidenii*.
19. Leaves plicate, long-acuminate. *campestre*.
 Leaves not plicate, shorter acuminate. *plumosum*.
20. Enlarged inflated alar cells numerous. 21.
 Alar cells scarcely or not at all inflated, often smaller and subquadrate. 22.
21. Inflated cells extending nearly or quite to costa; plants of the Rocky Mountain region. *Nelsoni*.
 Inflated cells confined to the angles; common. *rivulare*.
22. Branch leaves falcate-secund. 23.
 Branch leaves rarely if ever falcate-secund. 24.
23. Stem leaves lanceolate. *velutinum*.
 Stem leaves ovate to ovate-lanceolate. *Leibergii*.
24. Lower stem leaves strongly auriculate. *Washingtonianum*.
 Leaves not auriculate. 25.
25. Plants slender. 26.
 Plants robust. 27.
26. Costa extending to base of acumen, sometimes nearly percurrent. *Bestii* and *glaciale*.
 Costa extending little beyond the middle. *petrophilum*.
27. Leaves strongly plicate. 28.
 Leaves little or not at all plicate. 29.
28. Plants less robust; leaves more decurrent and more strongly serrate. *asperrimum* and *subasperrimum*.
 Plants more robust; leaves slightly or not at all decurrent and serrulate. *lamprochryseum*.
29. Leaves 0.6-0.8 mm. long; dioicous. *Bolanderi*.
 Leaves usually more than 1.5 mm. long. 30.
30. Monoicous; yellow-green; not complanate. *rutabulum*.
 Dioicous; dark green; usually somewhat complanate in American forms. *Starkei*.
31. Leaves falcate-secund. *erythrorrhizon*.
 Leaves not falcate-secund. *Wootonii*.
32. Leaves lax, spreading; alar cells abruptly enlarged and inflated. *edentatum*.
 Leaves closely imbricated or appressed; alar cells not inflated. 33.

* *B. erythrorrhizon suberythrorrhizon* may be sought here.

† *B. petrophilum* sometimes has the seta rather slightly roughened.

33. Stem leaves with long slender acumination *albicans*.
 Stem leaves abruptly short-acuminate *beringianum*.

BRACHYTHECIUM SALEBROSUM (Hoffm.) Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 549. 1853.

Hypnum salebrosum Hoffm. Deutschl. Fl. 2: 74. 1795.

Hypnum plumosum salebrosum C. Muell. Syn. 2: 359. 1851.

Brachythecium laevisetum Kindb. Bull. Torr. Bot. Club 17: 279. 1890.

Plants in wide glossy yellow-green mats; stems 5 cm. or more long, creeping and radiculose, irregularly to subpinnately branching; branches terete-foliate or seldom complanate-foliate; branch leaves lanceolate, 1.8-2.3 \times 0.5-0.65 mm., long-acuminate, serrate above, concave, with margins reflexed; costa extending beyond the middle; median cells linear-vermicular, 10:1; basal cells much shorter and broader; alar quadrate, thin-walled; stem leaves ovate-lanceolate, nearly entire, 2-2.5 by 0.8-1.1 mm.; perichaetium 2 mm. long; the leaves sheathing at base with spreading points; the inner rather abruptly narrowed into a long filiform acumination, entire or distantly serrate above; costa nearly obsolete. Monoicous. Seta 1-2 cm. long, red-brown, smooth; capsule red-brown, 2.5-3 mm. long, 2.5-3:1, oblong-ovoid, usually strongly arcuate and horizontal; operculum conic-apiculate; annulus very narrow and inconspicuous, often remaining attached to the operculum; teeth of peristome red-brown below; segments nearly as long as the teeth; cilia 2, well developed, nodose or subappendiculate; spores nearly smooth, 15 μ , maturing in autumn or early winter.

Type locality European.

On earth, stones, roots and trunks of trees, and rotting wood in woods and moist shady places. Eastern Canada and northern and eastern United States; less frequent west of Minnesota and Nebraska; south to North Carolina.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. 272.

EXSICCATI.—Sull. and Lesq. Musc. Bor. Am. (Ed. 1) 328, (Ed. 2) 487; Austin, Musc. Appal. 312 and 313; Macoun, Can. Musc. 283, 438 (*Hypnum acutum*); Grout, Musci Perfecti 26, 112; N. Am. Musc. Pl. 127, 218.

Distinguished from *B. oxycladon*, which it closely resembles, by being monoicous; by the shorter and more curved capsules and the more distant and open leaves, having a looser basal areolation; branch leaves also more slender-pointed. The capsules are very variable in length, sometimes almost exactly resembling those of *B. oxycladon*. An extremely variable species as at present understood.

A great variation in the appearance of the dried specimens appears to be due to the conditions of drying. Herbarium specimens with the leaves widely spreading and somewhat complanate, upon being wet and dried again took on the appearance that is characteristic of the species, the branches becoming terete-foliate and the leaves much more closely appressed, but there are straggling loosely foliate forms well represented by

Var. FLACCIDUM Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 550. 1853.

Plants in wide loose dark green mats; stem and branches slender; branch leaves distant, spreading, more or less complanate, strongly serrate, apex often twisted; stem leaves very broadly triangular-ovate, approaching in outline those of *B. Starkei*, about 2 \times 1.2 mm., very slenderly acuminate, slightly serrulate. Peristome with cilia often 3. Capsule much like that of *B. oxycladon*.

New Brunswick; Weehawken, N. J., and Oneida, N. Y. *B. salebrosum flaccidum* is the extreme broad-leaved form of the species and may be distinct, but at present our knowledge is insufficient to define it.

BRACHYTHECIUM FLEXICAULE R. & C. Mem. Torr. Bot. Club 6: 167. 1897.

Plants in wide loosely intricate mats, yellow-green, often brown underneath; stems creeping, densely radiculose, closely applied to the substratum, 5-12 cm. long, subpinnately branching; branches 5-10 mm. long, terete-foliate, ascending, attenuate; branch leaves narrowly lanceolate, 2-2.5 \times 0.5-0.65 mm., gradually narrowed to a very long slender apex, serrate, concave at base; margins somewhat reflexed; costa extending $\frac{1}{2}$ - $\frac{3}{4}$ length of leaf; median cells linear-vermicular, 12-14:1; basal cells broader and shorter; extreme alar cells subquadrate. Monoicous. Sporophyte usually not to be distinguished from that of *B. salebrosum*; capsule sometimes approaching that of *B. oxycladon*, 3-4:1. M. H. M. 274.

Type locality, John's Beach, Newfoundland, (Waghorne). On earth, Revelstoke, B. C. (Macoun, sent out as *B. glareosum*); on schistose rocks, Manchester, Vt.; New Jersey; on decaying wood, Bradford, Pa.; Adirondacks.

Type seen.

This species seems to me to be almost identical with *B. salebrosum densum* Br. & Sch. Bryol. Eur. *pl.*

550, but M. Cardot thinks otherwise. It is easily distinguished from all its near allies by the extremely narrow stem leaves, gradually narrowed from just above the base to the apex.

BRACHYTHECIUM ACUTUM (Mitt.) Sull. Icon. Musc. Suppl. 99. *pl.* 75. 1874.

Hypnum acutum Mitt. Journ. Linn. Soc. 8: 33. *pl.* 6.

Brachythecium mammilligerum Kindb. Macoun, Cat. Can. Pl. 6: 192. 1892.

Plants in wide thin glossy-green to yellowish-green mats; stems prostrate, creeping or sometimes floating, 5-10 cm. long, irregularly divided, radiculose at base, branching irregularly pinnatifid; branches few, 5-10 mm. long, frequently somewhat complanate-foliate, not radiculose; branch leaves distant, open, lanceolate to ovate-lanceolate, gradually narrowed from just above the base, ending in a very slender point, $1.6-2 \times 0.5-0.7$ mm., distantly serrate or entire, very slightly concave, little or not at all plicate; costa extending two-thirds the length of the leaf; median cells linear-vermicular, 10:1; basal and alar cells shorter and broader, oblong-rhomboidal to quadrate; stem leaves slender-pointed, triangular-ovate, nearly entire, 2-2.5 by 1 mm.; perichaetium 2.5 mm. long; the inner leaves ovate-lanceolate, sheathing at base, open above, abruptly long-filiform acuminate, ecostate. Monoicous, sometimes polygamous. Seta 2.5-3.5 cm. long, smooth, red-brown, often lighter colored above; capsule red-brown, oblong-ovoid to short-cylindric, 3 mm. long, 3:1, arcuate and inclined, occasionally nearly symmetric; operculum long-conic, apiculate; annulus simple, of 1 or 2 rows of cells; teeth of peristome subulate-lanceolate, orange; segments nearly as long as teeth; cilia 2 or 3, well developed, strongly nodose or appendiculate; spores minutely roughened, 13-15 μ , maturing in autumn.

Type seen, from Pack River, British Columbia (Lyll in Mitten herbarium). On the ground and rotting logs in moist and swampy places. Northern United States and Canada, across the continent; south to N. J., Ohio and Colorado.

ILLUSTRATIONS.—Mitt. l. c.; Sull. l. c.; M. H. M. 278.

EXSICCATI.—Austin, Musc. Appal. 316; Macoun, Can. Cryptogams 110 (*B. salebrosum mammilligerum*); Grout, N. Am. Musc. Pl. 213, 292, 447.

A careful comparison of a large number of specimens indicates that this species is distinct from the European *B. Mildeanum* Sch. The aspect of the plant is different in that it has loosely foliate and rather flaccid branches, while *B. Mildeanum* has more robust, densely foliate, turgid branches. The leaves are long, slender-pointed, more like *B. glareosum* than *B. Mildeanum*. Sullivant's figure resembles *B. Mildeanum* more closely than *B. acutum*. Mitten's figure represents the leaf much more accurately. Austin's Musc. Appal. 316, is, however, more like *B. Mildeanum* and Sullivant's figure and may prove to be distinct. There seems to be a complete series of intergradations between this species and *B. salebrosum*. The gradually tapering stem leaves which are seldom plicate and the more slender-pointed and less serrate branch leaves are the characters most easily recognized.

BRACHYTHECIUM CAMPESTRE Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 545. 1853.

Hypnum rutabulum campestre C. Muell. Syn. 2: 368. 1851.

Brachythecium subalbicans De Not. Cronaca, 2: 20. 1867. Epil. 118. 1868.

Plants in wide loose dark green to glossy yellow-green mats; stems 5 cm. or more long, decumbent or ascending, often stoloniferous at the ends; branch leaves equally spreading to somewhat falcate-secund, lanceolate to ovate-lanceolate, $1.4-2 \times 0.4-0.6$ mm., long-acuminate, strongly serrate above, concave, costate to the middle or beyond; median cells linear-vermicular, 10-12:1; basal cells shorter and broader; alar quadrate; stem leaves ovate-lanceolate, less strongly serrate, long subfiliform-acuminate, $2 \times 0.6-1.1$ mm., strongly plicate; perichaetium 2-2.5 mm. long; leaves sheathing at base, with squarrose points; inner leaves oblong-lanceolate, rather abruptly narrowed into a long-filiform serrate acumination, costate. Monoicous. Seta 1-2 cm. long, red-brown when old, more or less roughened with rather low distant papillae, nearly smooth below; capsule red-brown, 2.5-3 mm., 3:1, unsymmetric and inclined; operculum long-conic, apiculate; annulus narrow, usually adhering to the operculum; cilia 1 or 2, long, nodose and papillose-roughened; spores roughened, 15 μ , maturing in autumn.

Type locality European.

On damp earth and stones, in woods and in damp grassy places. Apparently has the range of *B. salebrosum*. As yet no specimens have been reported from farther south than New Jersey. Quesnelle, B. C. (Macoun).

ILLUSTRATIONS.—Br. & Sch. l. c.; *Pl.* 8.

EXSICCATI.—Aust. Musc. Appal. 314, 315; Grout, N. Am. Musc. Pl. 7, 345.

Scarcely to be distinguished from *B. salebrosum* except by the slightly scabrous seta, rather longer capsule and longer-acuminate leaves. There are all grades of roughness of seta and it is doubtful if this species is more than a variety of *B. salebrosum*. *B. oxycladon*, *B. glareosum*, *B. flexicaule*, *B. salebrosum*, *B. acutum*, *B. pseudocollinum* and *B. campestre* grade into each other and are difficult to separate satisfactorily.

BRACHYTHECIUM ALBICANS (Neck.) Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 553. 1853.

Hypnum sericeum gracile albicans Dill. Hist. Musc. 328. *pl.* 42, *f.* 63. 1741.

Hypnum albicans Neck. Meth. Musc. no. 36. 1771; also Hedw. Descr. et Adumb. 4: 13. *pl.* 5. 1793.

Hypnum flavescens Roth Fl. Germ. 3: 303. 1800.

Brachythecium pseudo-albicans Kindb. Bull. Torr. Bot. Club 17: 278. 1890.

B. salebrosum Waghornei R. & C. Bot. Gaz. 19: 238. 1894.

Plants in rather loose glossy light-green mats; stems decumbent or ascending, much divided, irregularly branching, slightly radiculose; branches erect or ascending, terete-foliate, slender, 5-15 mm. long; branch leaves decurrent, appressed-imbricate when dry, ovate-lanceolate, smaller and narrower toward the end of the branches, 1.6-2.2 \times 0.5 to 0.7 mm., slenderly long-acuminate, entire or rarely slightly denticulate, concave or bisulcate; margins more or less reflexed; costa extending beyond the middle; median cells linear-fusiform, 5-8 : 1; basal broader and shorter; quadrate alar cells numerous; stem leaves broader, 0.6-1 mm., wide, more abruptly narrowed to the slender acumination; perichaetium 2.5 mm. long; the leaves with loosely sheathing bases and spreading points; inner leaves exceedingly long-filiform acuminate from an oblong base, nearly entire, costa extending nearly through the body of the leaf. Dioicous. Seta 12-20 mm. long, sometimes 2 from 1 perichaetium, smooth, red-brown; capsule red-brown, ovoid, 2 mm. long, 2 : 1, unsymmetric, inclined or horizontal; little or not at all contracted under the mouth when dry; operculum convex-conic; annulus of 2 rows of cells, persistent; teeth of peristome linear-lanceolate, yellow brown; segments somewhat shorter than the teeth; cilia 2 or 3, appendiculate; spores finely roughened, 14-18 μ ; rarely fruiting.

Type locality European.

On rocks and in dry sandy or grassy places. Rocky Mountains and westward in northern United States and Canada; Agattu Id., Behring Sea; Alaska; Greenland (Fl. Gr.); Cape Breton Island; Newfoundland and Labrador, Waghorne.

ILLUSTRATIONS.—Dill. l. c.; Br. & Sch. l. c.; *Pl.* 7.

EXSICCATI.—Macoun, Can. Musc. 285; Grout, N. Am. Musci Pl. 197, 470, 490.

Distinguished from *B. salebrosum*, *B. acutum* and other closely allied species by being dioicous and by its very slender pointed and entire leaves. *B. glareosum*, rare in America, is also dioicous but is much more robust and its slender pointed leaves are serrate. *B. pseudoalbicans* Kindb., from the type collection, is a form with leaves rather shorter acuminate, occasionally bearing a very few inconspicuous teeth and with a rather larger number of quadrate alar cells. The leaves, however, are not more denticulate than is sometimes the case with European specimens.

Var. OCCIDENTALE R. & C. Bot. Centralbl. 44: 422. 1890.

More slender, more loosely foliate; leaves subsecund, shorter acuminate, denticulate. Montana (Röll.). Grout, N. Am. Musc. Pl. 164.

BRACHYTHECIUM PSEUDOCOLLINUM Kindb. Macoun, Cat. Can. Pl. 6: 196. 1892.

Plants in loosely intricate, dark green mats; stems creeping, subpinnately branching, radiculose; branches about 5 mm. long, terete-foliate; branch leaves erect-spreading, 1-1.2 \times 0.3-0.4 mm., very slightly decurrent, lanceolate, concave, serrate; margins reflexed at base; costa extending to middle; apex acute, slender, twisted; median cells linear, 8-10 : 1; basal shorter and broader, alar quadrate; stem leaves ovate-lanceolate, more loosely areolate, less strongly serrate, margins slightly reflexed, 1.4-1.6 \times 0.6 mm.; perichaetium about 2 mm. long, sheathing; inner leaves ovate-lanceolate, costate, rather abruptly narrowed to a long-filiform acumination, nearly entire, very loosely areolate, leaf-cells 13 \times 23 μ . Monoicous. Seta 15 mm. long, smooth, red-brown; capsule brown, ovoid-cylindric, 2 mm. long, 2-2.5 : 1, slightly unsymmetric, suberect; operculum long-conic; annulus lacking; segments as long as the teeth; cilia well developed, 1 or 2, strongly nodose or subappendiculate; spores 16 μ , strongly papillose.

Type locality under a well platform, Canaan Forks, N. B. (J. Moser); type seen. Also collected at Closter, N. J. (Austin); Connecticut, Young; Missouri, Bush; Alaska, Clark.

This is merely a reduced form or subspecies of *B. salebrosum*; practically the only important differences of importance are the smaller size and the shorter pointed leaves.

BRACHYTHECIUM SPLENDENS Aust. Bot. Gaz. 2: 111. 1877.

Brachythecium acuminatum subalbicans R. & C. Bot. Gaz. 15: 60. 1890.

Plants in dense glossy yellow-green mats, or sometimes dirty green; stems creeping, closely applied to the substratum, rhizome-like, 4-6 cm. long, sending up erect julaceous, densely foliate branches; branches terete-foliate, 5-20 mm. long; branchlets few; branch leaves erect, closely and regularly imbricate, broadly ovate-lanceolate to triangular-ovate, cordate-auriculate, slenderly long-acuminate, $1.5-2 \times 0.6-0.8$ mm., concave, 2 to 4 times plicate, distantly and finely denticulate; costa extending $\frac{2}{3}-\frac{3}{4}$ length of leaf; median leaf-cells linear, 12-15 : 1; basal and alar cells rhomboidal to quadrate; stem leaves broader, deltoid to triangular-ovate; apex long-subfiliform, resembling *B. albicans*; perichaetium 2.5 mm. long; the leaves sheathing at base with loosely erect tips; the inner ovate to ovate-lanceolate, abruptly narrowed to a long filiform acumination, distantly dentate-serrate above, thinly costate; the outer more strongly serrate and nearly ecostate. Dioicous (?). Seta 15 to 25 mm. long; smooth, dark chestnut; urn 2-2.5 mm. long, oblong-cylindric, erect and symmetric; teeth of peristome dark red-brown; segments narrowly linear, from a rather narrow basal membrane, yellow-brown; cilia single, slender.

Type locality, on palmetto trunks, St. Augustine, Fla., Feb., 1877 (J. Donnell Smith). On roots of cypress, Bellevue and Rosedale, Fla.; Louisiana.

No capsules except such as were old and deoperculate have been seen. The species is beautiful and distinct. It is distinguished from *B. biventrosus* by its much greater size and brilliant color and lustre. Austin's type is a small form of the species; this, perhaps, led him to confuse it with *B. biventrosus*.

BRACHYTHECIUM ROTEANUM DeNot. Cronaca, 2: 19. 1867; Epil. 117. 1869.

Brachythecium salebrosum var. *cylindricum* Br. & Sch. Bryol. Eur. fasc. 52-54. pl. 550. 1853.

Brachythecium salebrosum texanum Aust. Bull. Torr. Club, 6: 44. 1875.

Plants in glossy yellow-green mats; stems creeping, subpinnately branching; branches subjulaceous, 5-12 mm. long, terete-foliate; branch leaves more closely imbricated and appressed than in *B. salebrosum*, ovate-lanceolate, long-acuminate, $1.5-2 \times 0.45-0.55$ mm., serrate above, concave, often bisulcate with reflexed margins; costa extending $\frac{1}{2}$ to $\frac{2}{3}$ length of leaf; median cells linear-fusiform, 10-12 : 1; several rows of basal cells much enlarged, quadrate to oblong-hexagonal; lower stem leaves ovate, abruptly narrowed to a long slender acumination, nearly entire, $2-2.4 \times 0.9$ mm.; areolation much looser; upper stem leaves approaching branch leaves in size and shape; perichaetium 2.25 mm. long; leaves sheathing at base with spreading points; inner oblong-ovate, long-acuminate, nearly ecostate and entire. Monoicous. Seta 2.5 cm. long, red-brown, smooth; capsule red-brown, cylindric, nearly erect, slightly arcuate, about 3 mm. long, 4 : 1; operculum conic-rostrate; annulus (?), cilia 2 or 3, well developed, nodulose; spores granulose-roughened, 13 μ .

Type locality European.

Dallas, Texas (J. Boll); La., Drumm. Musc. Am. (S. States 123 "*Hypnum laetum* var?") Robinson's Spring, Florida, Grout.

Distinguished from *B. oxycladon* by being monoicous and by the conspicuously enlarged basal cells of the leaves; from *B. salebrosum* by the longer suberect capsule and leaves scarcely or not at all plicate; from both by its much shorter-acuminate perichaetial leaves. The American form here described is clearly distinct from either *B. salebrosum* or *B. oxycladon*, and is referred to *B. Roteanum* on the authority of C. Mueller, who identified a specimen of Boll's collection now in the Columbia Herbarium as *B. salebrosum cylindricum* Br. & Sch. I have not had authentic European material for comparison but the plant described answers very closely indeed to Limpricht's description of *B. Roteanum* (Rab. Krypt. Fl. 4³: 72). The specimen Austin described was from the same locality and collector as the specimen identified by Mueller.

Austin's type of var. *texanum* has the leaves little narrowed at the insertion, less concave and with margins little reflexed and the short broad basal cells are numerous and clear, this with its less shining appearance and more open leaves easily distinguishes it from *B. splendens*. I am strongly inclined to the belief that Austin's plant is not the same as the European *B. Roteanum* but I lack definite evidence.

BRACHYTHECIUM OXYCLADON (Brid.). Jaeger & Sauerb. St. Gall. Nat. Gesell. 1877-1878: 322.

Hypnum oxycladon Brid. Musc. Recent. Suppl. 2: 123. 1812.

Hypnum laetum Brid. Bryol. Univ. 2: 479. 1827.

Brachythecium laetum Br. & Sch. Bryol. Eur. fasc. 52-54. pl. 554. 1853.

Brachythecium spurio-acuminatum C. Muell. & Kindb. in Macoun, Cat. Can. Pl. Pt. 6: 191. 1892.

Plants in wide glossy yellow-green intricate mats; stems prostrate, irregularly divided, pinnately branching; branches unequal, 0.5-2.5 cm. long, attenuate at ends; upper branch leaves erect-open, ovate-lanceolate, slightly decurrent, $1.5-2 \times 0.45-0.8$ mm., acute to slenderly acuminate, apex often slightly twisted, serrulate nearly all around, concave, plicate, upper margins often slightly recurved; costa extending beyond the middle; median cells narrowly linear, 10 : 1; areolation gradually becoming shorter and broader toward the base; alar cells quadrate; stem leaves larger, $2-2.5 \times 0.9-1.2$ mm., often nearly entire, more deeply plicate; perichaetium 2-2.5 mm. long; leaves sheathing at base; the inner with spreading points, oblong-lanceolate, abruptly narrowed to a long filiform acumination, nearly entire or somewhat serrulate above, costa thin or wanting. Dioicous or rarely monoicous. Seta 1.5-2.5 cm. high, red-brown, smooth; capsule red-brown, oblong-cylindric, suberect, slightly arcuate, somewhat contracted below the mouth when dry, the neck gradually narrowed to the seta, 2.5-3.5 mm. long, about 4 : 1; operculum long-conic to conic-rostrate; annulus none; teeth of peristome light red-brown, rather abruptly narrowed to a slender hyaline point; segments from a broad basal membrane, nearly as long as the teeth; cilia two, strongly nodose or appendiculate; spores finely papillose-roughened, about 15μ , maturing in autumn or early winter.

Type locality, Pennsylvania (Ludwig).

On earth, rocks, and roots of trees in woods. Northeastern United States and eastern Canada; west to Minnesota, Kansas and Nebraska; Colorado (Brandege); south to North Carolina and Tennessee; Missouri (Bush). Apparently common.

EXSICCATI.—As *H. laetum* Drumm. Musc. Am. (S. States), 122; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 329, (Ed. 2) 488, 489, 490; Austin, Musc. Appal. 309; Macoun, Can. Musc. 281, 566 (*B. spurio-acuminatum*); R. & C. Musc. Am. Sept. Exsic. 104, (*B. biventrosus*); Grout, N. Am. Musc. Pl. 198, 199.

ILLUSTRATIONS.—Br. & Sch. l. c.; Sull. Icon. Musc. pl. 115; M. H. M. 275.

Type specimens of both *B. oxycladon* and *B. laetum* have been examined. The branch leaves of the former are less serrate than those of the latter but the acumination and serration of the leaves varies so much, even on the same plant, that these characters alone cannot be used even to separate varieties. The species is exceedingly variable and it is difficult to separate varieties from its allies, especially *B. salebrosum*; the difficulty is increased by the fact that the species is very imperfectly dioicous.

Examination has been made of authentic specimens of *B. laetum* var. *fallax* R. & C. (Bot. Centralbl. 44: 422. 1890), *B. laetum* var. *pseudo-acuminatum* R. & C., l. c.; *B. laetum* Roellii R. & C., l. c.; from type locality and from Herb. Cardot. The variety *fallax* seems to be nothing more than a local form with narrower leaves and a more dirty green color; var. *pseudoacuminatum* is a dwarfed and more caespitose plant, but differs in no essential particular from the ordinary form of *B. oxycladon* except, perhaps, in the more slender pointed branch leaves. Var. *Roellii* is not at all like *B. laetum*, having short julaceous branches and ovate to ovate-lanceolate leaves of about $\frac{1}{2}$ the size of the leaves of *B. laetum*. All of these varieties were sterile and the species in the *salebrosum* group of *Brachythecium* are too closely related to make valid varieties from sterile specimens.

Renaud & Cardot's 104 differs in no essential respect from the ordinary *B. oxycladon* but as compared with the type of *B. biventrosus* it is larger and stouter; leaves broader and less slender pointed, basal areolation that of *B. oxycladon*. I am unable to agree with the opinion expressed by M. Cardot in Hedwigia 35: 308, 310. 1896. M. Cardot tells me that he has not seen type specimens of *B. biventrosus* C. Muell. The specimens communicated by Lesquereux could not have been this species or he would not have confused it with *B. laetum*. *B. biventrosus* is very closely related to *B. acuminatum*, as is indicated by the erect capsule, imperfect peristome and general appearance.

B. oxycladon has typically branch leaves broader than in *salebrosum*, reaching 2×0.8 mm., less slenderly acuminate; stem leaves broader, more strongly plicate, with the quadrate alar cells smaller, thicker walled and often apparently more numerous: typically dioicous but not constantly so. It has the same habits and range as *B. salebrosum*, but it less frequently grows on decaying wood. In many cases the sporophyte of *B. salebrosum* is very much darker than in this species.

I have seen *salebrosum*, with the capsules as long and slender as those of *oxycladon* and *oxycladon* with capsules as short as those of *salebrosum* but this is not very frequent and the sporophyte characteristics are usually sufficient to separate these two species.

I am able usually to differentiate sterile and ambiguous specimens of *B. salebrosum* and *B. oxycladon* by the difference in the alar and basal cells which are fairly well illustrated in the figures. In *B. salebrosum* there are usually two or three rows of shorter, rather irregular cells along the whole base of the leaf and at the angles these large loose subquadrate cells are quite characteristic. In *oxycladon* these basal and alar cells are rather smaller and thicker walled.

B. oxycladon resembles *Hypnum Haldanianum* in appearance but has plicate leaves, is more glossy and has a shorter operculum. Under the microscope the presence of a costa at once differentiates it.

To sum up: if one has a *Brachythecium* that answers in a general way to the descriptions of *salebrosum* and *oxycladon*, is monoicous, has short curved capsules, leaves little plicate when soaked out on a slide (exclusive of the two large folds due to the concavity of the base), long and slenderly acuminate with basal cells rather loose like those figured in Plate LXII, M. H. M. then he has a clear case of *B. salebrosum*.

If the plant be dioicous, with long-cylindric, little curved capsules, stem leaves strongly plicate even

when mounted in water, basal and alar cells smaller and denser as figured in Plate LXIII, M. H. M., then he has a clear case of *B. oxycladon*. If one has a plant that will not exactly fit either of the above cases let him study it carefully and put it with the species it most resembles. There are a large number of intermediate forms in America that cannot be placed certainly, especially if sterile.

There seems to be good reason for believing that the American *salebrosum* approaches *oxycladon* much more closely than do the European forms of the species.

I have what is considered to be a portion of the plant from which Sullivant made his drawings of *B. laetum* and it is one of the forms running close to our *salebrosum*. European *salebrosum* seems to have the leaves less concave at base and more like *rutabulum*. The plant called *laetum* in Europe is much closer to our var. *dentatum* than the plant figured by Sullivant.

Forma FALCATUM Grout.

A very interesting xerophytic form unlike anything I have seen before. The plants are bright yellow with short stems and branches which are more or less curved at the ends; leaves strongly falcate-secund. Plants sterile.

Dry sandy shores of Douglas Lake, Michigan, June-August, 1920. G. E. Nichols, No. 141.

NOTES on *B. oxycladon*, its var. *dentatum* and *B. digastrum* by H. Dupret, Bryologist 30: 58.

"The apical stem-leaves (innovations) are generally of a larger size than the middle stem-leaves in the same plant. Generally, also, the acumination of the middle leaves is longer than in the apical leaves. The examination of the size in the apical leaves is generally conclusive; for example, if at least two or three leaves present a wide base joined to a short acumen, it is a clear case of *B. digastrum*. Should the examination of the apical leaves not settle the doubt then take off all the branches and examine the lower leaves of the stem."

"Note carefully the differences in the acumination of the leaves of each species:

a. In *digastrum* the leaves may be barely acute; they are generally short-apiculate.

b. In *oxycladon* the leaves are clearly and sometimes very long-acuminate, with twisted acumen.

c. In *dentatum* all the leaves are barely acute, obtuse-acute or very short apiculate. Besides, they are very concave and noticeably plicate under the glass; also very asymmetric."

"The basal cells in *digastrum* and *dentatum* are large quadrate-rectangular, but not as clear as in *B. salebrosum*. In *oxycladon* they are theoretically smaller, sometimes roundish-globular. It should be borne in mind that the areolation, alone, is seldom conclusive, of itself; it must be considered only as a confirmation.

"The upper areolation is so finely-compressed in *oxycladon* as to be almost indistinct. It is a little shorter and laxer in *digastrum*, conspicuously shorter still in *dentatum*;* but all specimens are not typical in this respect, hence the statement above that the sole consideration of the areolation is not conclusive. More stress should be laid on the shape of the leaves, especially the apical and stem leaves. As for the branch leaves, they are, in many cases, so much alike in form in the three plants of the group that it is useless to waste much time with them."

"In short, in apical leaves, a very wide base, joined with a short acumination, points to *digastrum*. Not quite so wide a base, joined with a comparatively long acumination, is a sign of *oxycladon*, and, especially the long fine twisted acumen. A round-oval short base, joined to a barely acute apex, is the ordinary sign of *dentatum*. In this latter plant the apical and branch leaves have about the same shape, except that the branch leaves are narrower."

"As far as I know, *digastrum* is a rarer plant than either *dentatum* or *oxycladon*, which are quite abundant here, especially on rocks near the ground or along moist paths in the woods."

Var. DENTATUM (L. & J.) Grout. l. c.

Hynum laetum dentatum L. & J. Mosses of North America 335. 1884.

Brachythecium Sullivantii Br. & Sch. Bryol. Eur. fasc. 52-54: Mon. 21. 1853.

Plants often submerged and dirty brownish green below; stems and branches slender, stem leaves broader and shorter, acute to acuminate, serrulate; branch leaves shorter pointed and more strongly serrate, more loosely areolate at base. Seta 3-3.5 cm. long, very slightly roughened at base; operculum short-rostrate; apparently growing in wet places on rocks and earth.

EXSICCATI.—Sull. Musc. Allegh. 43, in part only; Grout, N. Am. Musc. Pl. 122.

A very common form growing on moist rocks. The leaves are more strongly plicate, shorter and broader, shorter acuminate to acute; the leaf cells are also broader and shorter, the short basal and the quadrate alar cells much more numerous; seta occasionally somewhat roughened at base; operculum short-rostrate; apparently more common than the species in our region and passing into the next species by intergrading forms.

Forms of *B. oxycladon dentatum* from Green Knob, N. C., alt. 5,000 ft., show *B. digastrum* in the same tuft and sometimes one portion of a plant appears to be *B. oxycladon dentatum* and another portion, *B. digastrum*.

BRACHYTHECIUM DIGASTRUM C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 190. 1892.

Plants in wide, olive-green mats; stems radiculose, creeping and closely applied to the substratum, pinnately branching; branches 5-10 mm. long, subjulaceous, terete-foliate; branch leaves loosely appressed-imbriate when dry, erect-open when moist, ovate to oblong-ovate, acute to short-acuminate, with apex

* ?? A.J.G.

more or less twisted, 0.8-1 mm. long and about $\frac{1}{2}$ as broad, decurrent, bisulcate, very concave; margins reflexed below, serrulate; costa stout, extending $\frac{2}{3}$ - $\frac{3}{4}$ length of leaf; median cells fusiform-hexagonal, 5-7 : 1; basal much shorter; quadrate alar cells numerous; stem leaves triangular-ovate, longer acuminate, more loosely areolate at base, less conspicuously serrulate, 1.2×0.8 mm.; inner perichaetial leaves 2-2.5 mm. long, sheathing; leaves slightly or not at all reflexed at apex, oblong-ovate, thinly costate, very loosely areolate, rather abruptly contracted into a long-filiform flexuous acumination, slightly denticulate or entire. Monoicous. Seta 15-20 mm. long, red-brown, smooth; capsule brown, oblong-arcuate, subhorizontal, 2-2.5 mm. long, 3 : 1; operculum long-conic, apiculate; segments shorter than the teeth; "cilia nodulose, not appendiculate, annulus none."

Type locality, McKay's Bush, Ottawa, Ont., Oct. 12, 1889, (Macoun). On rocks, Canada, Macoun and others, but probably to be found in the northeastern United States as well as in North Carolina.

ILLUSTRATION.—M. H. M. 277.

A careful study of *B. oxycladon* in its varying forms has led me to repudiate my former statement about it and *B. digastrum*. I regard *B. digastrum* as a derivative of *oxycladon* through the var. *dentatum* even though it is monoicous. It has been so little collected that the variations of the capsules are not well known and I expect forms to be found with capsules longer than those described above.

BRACHYTHECIUM WOOTONII Grout, Bryologist 29: 8. 1926.

Habit and appearance of *B. oxycladon*, but stems and branches shorter, as if depauperate or alpine. Stem leaves triangular-ovate, plicate with margins recurved below, long and slenderly acuminate, entire or slightly denticulate at apex; branch leaves ovate-lanceolate, scarcely plicate but concave at base with recurved margins, almost as slenderly acuminate as in *B. albicans*, but serrate in the upper half. Seta short; capsules small, suberect to horizontal; peristome normal, but the cilia uncertain by reason of the age of the capsules.

Except for the very long and slenderly acuminate leaves and small capsules, this plant would be referred to depauperate *B. oxycladon*. If it were more robust, with longer, more plicate and less serrate leaves and larger capsules, it would be hard to differentiate from *B. glareosum* B. & S. Indeed, I at first referred it to this species.

Type from Gilmore's Ranch, White Mts., Lincoln Co., New Mexico, Aug. 25, 1907. Alt. 7500 ft. E. O. Wooton and Paul C. Standley.

Type in herbarium of A. J. Grout.

BRACHYTHECIUM GLAREOSUM (Bruch.) Br. & Sch. Bry. Eur. Fasc. 52-54, Mon. 19. pl. 552. 1853.

Hypnum glareosum Bruch in sched., C. Muell. Syn. 2: 361. 1851.

A subspecies of *B. salebrosum* distinguished in typical forms by its larger size; leaves more plicate and long and slenderly acuminate as in *B. albicans*, but somewhat serrate above though usually less strongly so than in *salebrosum*. Dioicous. I have seen two collections that seem to belong to this species. One I collected from near Tolland, Colorado on soil in a coniferous forest, the other was collected by Mrs. F. A. MacFadden near New Denver, British Columbia. Both these plants are rather more slender than the typical European form. *B. albicans occidentale* approaches these slender forms closely but is not so loosely foliate. Anybody that can feel absolutely sure of identifying accurately all the myriad forms of the Western relatives of *B. salebrosum* has more confidence in himself than I have ever been able to attain. (Pl. 7.)

BRACHYTHECIUM TURGIDUM (Hartm.) C. Hartm. Kindb. Enum. 294. 1888.

Hypnum turgidum Hartm. Skand. Fl. Ed. 5: 328. 1849.

Hypnum plumosum turgidum Lindb. Musc. Scand. 36. 1879.

Plants in glossy, whitish-green to golden-green tufts; stems creeping, irregularly branching; branches very stout and turgid, julaceous, pointed, sometimes ending in flagella, 1-3 cm. long; leaves loosely appressed-imbricate, somewhat decurrent, lanceolate to broadly ovate-lanceolate, $2.5-3.5 \times 0.9-1.2$ mm., entire, gradually narrowed to a long-filiform acumination, strongly plicate, costate to middle; margins reflexed below; median leaf-cells 12-15 : 1; basal broader and shorter; alar rhomboid-quadrate; stem and branch leaves little different; perichaetial leaves sheathing, long-acuminate, entire, ecostate. Monoicous. Seta 1-2 cm. long, red-brown, smooth; capsule 3-3.5 mm. long, 3 : 1, subhorizontal, curved, somewhat con-

tracted under the mouth when dry; operculum conic; annulus of one row of cells; cilia one or two, nodose; spores 18–24 μ , nearly smooth, maturing in autumn.

Type locality European.

In alpine or boreal regions in grassy or stony places. Battle Harbor, Labrador; Stephen, Rocky Mts.; Lake St. John, Quebec; Greenland (Fl. Gr.). This species has much the appearance of *B. glareosum* but differs in its more turgid branches, entire leaves and in being monoicous. Not yet found fruiting in America. The description of the sporophyte is adapted from Limpricht.

BRACHYTHECIUM EDENTATUM Williams, Bryologist 6: 62. July, 1903.

"Low and loosely caespitose with lax, spreading leaves. Stems procumbent, with few, short and irregular branches. Stem leaves $1\frac{1}{2}$ mm. long by $\frac{3}{8}$ mm. wide, not decurrent, pale, ovate-lanceolate, shortly acuminate, concave, scarcely or not plicate, margin entire, flat; costa rather faint, extending a little above the middle, rarely shorter and forked, with sometimes small clusters of radicles on lower side at its base. Branch leaves smaller, entire. Leaf-cells above the base very narrow, the median .004 to .005 mm. wide and .04 to .05 mm. long. Alar cells abruptly enlarged, hyaline, often forming distinct, inflated, convex clusters. Perichaetial leaves but little longer than stem leaves, gradually acuminate, half costate, very entire. Dioicous. Pedicel smooth, up to $2\frac{1}{2}$ cm. high. Capsule when moist about two and one-half times longer than broad, curved, much contracted under the mouth when dry. Annulus narrow. Height of conical lid scarcely equaling its basal diameter. Segments of inner peristome solid, with two or three smooth cilia between."

"This is one of the smaller species, in size perhaps nearest *reflexum*. It seems quite distinct from all others in the very entire leaves, with narrow cells above and inflated clusters in the angles. It differs from *B. Beringianum* Card. & Ther. in having the majority of leaf-cells little more than half as wide, in the different alar cells and in the low, creeping stems with lax, spreading leaves (374). Gold Run Cr., on wet earth, June 6." (Gold Run Creek, Alaska.)

BRACHYTHECIUM BERINGIANUM Card. & Ther. Proc. Wash. Acad. Sci. 4: 333. 1902.

"Densely caespitose, resembling in habit small forms of *B. albicans*. Stem erect, 3–4 cm. high, much branched, branches erect, sometimes fastigate, julaceous, acute. Leaves crowded, imbricate, the stem leaves 1.5 mm. long, 0.8 broad, ovate-lanceolate, from a slightly decurrent base, quite abruptly and shortly acuminate, concave, plicate, with margins entire, plane or reflexed; the branch leaves smaller, longer acuminate; costa thin, 30–35 μ thick scarcely reaching the middle; "alar cells numerous, quadrate, elongated in the five to six rows next to the margin, the rest linear, 40–45 μ long, 6–7 broad; walls incrassate. Other characters unknown." Pl. 7.

"From St. Paul Island (Trelease, 1861, 2087); Agattu Island (U. S. S. Albatross Exped., 40)."

"Distinct from *B. acuminatum* R. and C. by its habit, its more abruptly acuminate leaves, etc. It more closely resembles *B. albicans* Br. Eur., from which it differs by its shorter and more abruptly acuminate leaves, its quadrate, more numerous alar cells, its more chlorophyllose areolation, and by its narrower, short and often bifurcate costa."

BRACHYTHECIUM RUTABULUM (L.) Br. & Sch. Bryol. Eur. fasc. 52–54. pl. 543 and 544. 1853.

Hypnum rutabulum L. Sp. Pl. 1124. 1753.

Hypnum dentatum var. *vulgatissimum operculis obtusis*. Dill. Hist. Musc. 295. pl. 38, f. 29. 1741.

B. leucoglaucum C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 198. 1892.

B. marabundum C. Muell. & Kindb. Cat. Can. Pl. 6: 194. 1892.

Plants robust, in wide, loose mats, glossy yellow-green; stems decumbent, arcuate, 5–10 cm. long, stoloniferous at the ends, irregularly divided, subpinnately branching; branches erect or ascending, 1–2 cm. long, gradually attenuate, terete-foliate to somewhat complanate-foliate; branch leaves loosely erect-spreading, ovate-lanceolate, very slightly decurrent, 1.5–2 \times 0.5–7 mm., gradually long-acuminate, distantly serrate, slightly concave, scarcely plicate; costa extending $\frac{3}{8}$ length of leaf, sometimes toothed on the back above; median cells linear, 15 : 1; basal cells little differentiated, somewhat shorter; stem leaves broadly ovate, more abruptly acuminate, 2–3 \times 1–1.5 mm., less strongly serrate, more strongly decurrent; basal leaf cells conspicuously broader and shorter; a few of the cells at the extreme angles enlarged and inflated, denticulate above; inner perichaetial leaves about 3 mm. long, sheathing at base with squarrose

points; the inner oblong-ovate, rather abruptly narrowed to a very long filiform acumination, denticulate above, ecostate, the outer leaves often short-costate. Monoicous or rarely polygamous. Seta 2-3 cm. long, red-brown, very rough throughout; capsule red-brown, oblong, arcuate and horizontal, not contracted under the mouth when dry, 2.5-3.5 mm. long, about 1 mm. thick; operculum long-conic, apiculate to subrostellate; annulus of two rows of cells, persistent; teeth of peristome red-brown, margined, stout; segments nearly as long as the teeth; cilia 2 or 3, nodose, some often imperfectly developed; spores roughened, 13-16 μ , maturing in winter.

Type locality European.

On the ground and stones in wet places, less frequently on roots and stems of trees and decaying logs. Northern United States and Canada; south to New Jersey and Pennsylvania. Columbia Falls, Montana (Williams); Missouri, Bush.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. p. 279.

EXSICCATI.—Sull. Musc. Allegh. 45; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 331, (Ed. 2) 494 and 495; Austin, Musc. Appal. 318; R. & C. Musc. Am. Sept. Exsic. 243; Grout, N. Am. Musc. Pl. 66, 170, 171, 421 453, 500.

Quite variable in size and shape of leaves and in gross appearance. Macoun's Can. Musc. 591 on which *B. leucoglaucum* C. Muell. & Kindb. was founded has the seta very rough and cannot be distinguished from this species.

Var. FLAVESCENS (Brid.) Br. & Sch. Bryol. Eur. fasc. 52-54. pl. 544.

Hypnum flavescens Brid. Spec. Musc. 2: 185. 1812.

Brachythecium platycladum C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 195. 1892. Can. Musc. 287, in part.

Plants straw-colored, very stout; stem and branches loosely foliate, turgid; stem leaves very broadly ovate, concave, abruptly short-acuminate. With the typical form. Montana; Jamaica Plains, Mass.

At first sight this form seems distinct from *B. rutabulum* but there is a complete gradation of forms from the typical plant to the variety. The stem leaves often resemble those of *B. rivulare* but they are longer acuminate and some of the branch leaves are not much different from those of typical *B. rutabulum*. Pl. 8.

This variety seems imperfectly dioicous, as both Kindberg and R. S. Williams describe it as dioicous. The Columbia specimen of Macoun's 287 (which is undoubtedly the same as that described by Kindberg) contained plants which bore both male and female branches.

Var. TURDESCENS Limpr. Laubmoose 3: 109. July, 1926.

In swampy places not far removed from tide-water, there occurs a form which is golden-green with rather short and very thick turgid branches densely foliate with leaves somewhat striate and loosely imbricate, which I have referred to var. *turdescens*. The turgid terete leafy branches are 2 mm. or more in diameter.

BRACHYTHECIUM ASPERRIMUM Mitt. Journ. Linn. Soc. 8: 33. 1865.

Hypnum vallium Sull. & Lesq. Musc. Bor. Am. Ed. 2, 506. 1865.

B. Villardi R. & C. Bot. Centralbl. 44: 442. 1890.

B. gemmascens C. Muell. & Kindb., Macoun, Cat. Can. Pl. 6: 195. 1892.

B. spurio-rutabulum C. Muell. & Kindb. l. c. 197.

B. columbico-rutabulum Kindb. l. c. 198.

B. subintricatum Kindb. Rev. Bryol. 22: 86. 1895.

Plants in wide loose mats, yellow-green; stems 5-11 cm. long, decumbent or ascending and arcuate, stoloniferous at the ends, sparingly radiculose, pinnately branching; branches 5-15 mm. long, attenuate at the ends, terete-foliate; branch leaves rather distant, erect-open, occasionally somewhat falcate-secund, long-decurrent, ovate-lanceolate, gradually long and narrowly acuminate, strongly serrate above, somewhat concave and plicate, $1.6 \times 0.45-0.6$ mm., costate to beyond the middle; median cells linear, reaching 90 μ long, 10-15 : 1; basal and alar cells little differentiated, somewhat shorter and broader; stem leaves varying from broadly ovate and rather abruptly acuminate to elongated triangular-ovate and gradually long and slenderly acuminate, strongly plicate and decurrent, less strongly serrate, often nearly entire, basal cells more differentiated. Dioicous; male plants smaller and more slender; leaves more distant and narrower; antheridial branches large, subglobose; perichaetium 2.5 mm. long; the leaves with sheathing bases and squarrose recurved points; inner leaves oblong-ovate, rather abruptly long-filiform acuminate, costate. Seta 2-4.5 cm. long, red-brown, very strongly papillose; capsule red-brown, 2.5 mm. long, 2.5-3 : 1, oblong-ovoid, arcuate and horizontal, somewhat contracted under the mouth when dry and empty; operculum conic-apiculate; annulus present; cilia 2 or 3, strongly nodose; spores roughened, 13-20 μ , maturing in early winter.

Type locality, British Columbia (Lyll and Douglas).

On moist rocks, soil, and decaying wood. California, Idaho, Montana and intervening territory. British Columbia. Not yet reported east of the Rocky Mts.

ILLUSTRATIONS.—Sull. Icon. Musc. Suppl. *pl.* 76; Mitt. l. c.; *Pl.* 10.

EXSICCATI.—Sull. & Lesq. l. c.; Grout, N. Am. Musc. Pl. 154, 154a, 237 (as *B. albicans*).

Distinguished from *B. rutabulum*, which it resembles by being dioicous and having a much more slender habit. I have examined a portion of the type and find that it has long-filiform acuminate perichaetial leaves, although this is not in accordance with either Sullivant's or Mitten's figures. Specimens of *B. spurio-rutabulum* from Burrard's Inlet (Macoun, Can. Musc. 651) contain *B. asperrium* mixed with another sterile moss which has very strongly plicate leaves. Authentic specimens of *B. columbico-rutabulum* from type collection can be separated from *B. asperrium* by nothing excepting that they are said to be monoicous: no male branches could be found on any of the plants examined. Type specimens of *B. gemmascens* are certainly dioicous; they grew on a wet log and were apparently submerged at times, thus giving an unusual appearance to the plant: its principal leaf characters are identical with those of *B. asperrium*. Cardot writes that he is sure *B. Villardi* is distinct from *B. asperrium*, as he found male and female branches on the same plant. I, however, am not able satisfactorily to differentiate it and a specimen from Cardot himself seems dioicous, as a great abundance of male branches were found on one of the plants examined, but not a single female branch. Specimens of *B. subnitricatum* from type collection are not distinguishable from *B. asperrium*.

The branch leaves are more strongly serrate than figured by Sullivant.

BRACHYTHECIUM SUBASPERRIUM Card. & Ther. Bot. Gaz. 37: 377. *pl.* 24, 1. May, 1904.

B. pacificum Jennings Bryologist 16: 95. Nov. 1913.

Subspecies of *B. asperrium*. Differs in the softer flaccid tissue of the leaves which are also more plicate with leaf cells shorter, 6-7 μ wide by 45-70 μ long; the shorter basal and alar cells rather more numerous. Stem leaves often more broadly ovate than figured. *Pl.* 10.

Dr. Jennings has very courteously sent me a part of his type which I have carefully compared with that of Mitten. I find some of the branch leaves on Jennings' plants to be as strongly serrate as those of Mitten's.

Type from New Westminster, British Columbia, A. J. Hill, April, 1902. Jennings' type from Skidgate, Queen Charlotte Islands, W. Spreadborough, July 1, 1910. In Herb. Carnegie Museum.

EXSICCATI.—Baker, Pacific Coast Bryophytes 582 (apparently type duplicate); Grout, N. Am. Musc. Pl. 221 (Seattle, Bailey).

BRACHYTHECIUM LAMPROCHRYSEUM C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 199. 1892.

Plants in wide thick tufts, glossy golden-yellow to yellow-green, brown underneath; stems very stout, 5-10 cm. long, creeping and long persisting, ascending at the ends, irregularly divided, sending up numerous secondary stems; secondary stems 3-5 cm. high, irregularly branching, often slightly curved at the ends; branches few or numerous, 5-10 mm. long; cortical cells of stem large, often remaining as a row of inflated cells at base of leaf; branch leaves crowded to rather distant, slightly or not at all decurrent, open, ovate to ovate-lanceolate, 1.2 \times 0.6 mm., acuminate with apex twisted, denticulate all around, strongly plicate; costa stout, extending $\frac{2}{3}$ - $\frac{3}{4}$ length of leaf; median cells linear-oblong, 7-10 : 1; basal somewhat shorter and broader; alar not differentiated; stem leaves triangular-ovate, slightly auricled, 2-2.5 \times 0.8-1.2 mm., more loosely areolate, very strongly plicate; basal and alar cells oblong to elliptical; costa extending $\frac{1}{2}$ the length of the leaf, very slender above; perichaetium 2-3 mm. long; leaves sheathing at base, with squarrose-reflexed tips; inner leaves lanceolate, long-filiform acuminate, nearly ecostate. Dioicous. Seta 2-3 cm. long, brown, very rough; capsule brown, oblong-cylindric, 2-2.5 mm. long, 2.5-3 : 1, suberect to horizontal, unsymmetric to arcuate; operculum long-rostrate when dry; $\frac{1}{3}$ to $\frac{1}{2}$ length of urn; when moist, long and conic rather than rostrate; teeth long-filiform pointed; segments slender, as long as the teeth, widely open between the articulations; cilia 2, nearly as long as the segments, appendiculate; spores roughened, 16-20 μ . *Pl.* 14, f. 12.

On decaying wood in moist places, California; Colorado; Oregon; Washington; in calcareous springs, Idaho; apparently common in British Columbia and Alaska.

The long-rostrate operculum would seem to place this in *Eurhynchium* if this character only was considered, but all its other characters place it in close relationship with the *rutabulum* group of *Brachythecium*, nearly all of which have subrostellate opercula.

EXSICCATI.—Grout, N. Am. Musc. Pl. 254, 327, 338.

The plant from Comox, Vancouver Id., from which Kindberg evidently described the sporophyte, is *B. asperrium*, hence some discrepancies in the description. The sterile specimens from Mt. Benson and

Mt. Finlayson should be regarded as the type. This species has much the aspect of *B. turgidum*, but has dentate, shorter pointed leaves and rough seta. It is distinguished from *B. rivulare* by its much longer-pointed strongly plicate leaves and less differentiated alar cells. It is nearest *B. Washingtonianum*, which is distinguished by its auriculate stem leaves. It is as a rule much larger than *B. asperrium*, of which it seems to be a derivative.

Var. GIGANTEUM Grout, Mem. Torr. Bot. Club 6²: 181. 1897.

Stems much stouter, secondary stems with fewer branches; stem leaves distant, longer, 3-3.5 mm. long, very strongly plicate; extreme alar cells inflated. Capsule ovoid; operculum conic-rostrate, annulus large, persistent; segments as long as teeth, from a very broad basal membrane; cilia 2 or 3, well developed, nodose; spores maturing in winter. The stem leaves are somewhat auricled and it is possible this variety might better be referred to *B. Washingtonianum*.

Type from Atku Island, Behring Sea. British Columbia, Mrs. MacFadden.

EXSICCATI.—Grout N. Am. Musc. Pl. 489.

Var. SOLFATARENSE Grout, N. Am. Musc. Pl. 327. Sept. 1, 1910.

A slender elongated lax form with very loosely areolate strongly decurrent leaves. Mixed with *B. rivulare*.

Type from Solfatara Creek, Yellowstone National Park, Mrs. M. B. Streeter.

BRACHYTHECIUM WASHINGTONIANUM (Eaton, Ms.), Grout Bryologist 3: 12. July 1900.

Plants in loose mats of bright glossy yellow-green; stems creeping, ascending, 5-10 cm. long, closely and more or less regularly pinnate, particularly near the ends; branches 7-12 mm. long; branch leaves equally spreading, strongly plicate, both moist and dry, ovate, not decurrent, $1.5-1.75 \times 0.45-0.70$ mm., broadest a little above the base and thence gradually narrowed to a long narrow apex, more strongly serrate above than in *B. lamprochryseum*; costa extending from one-half to two-thirds the entire length of the leaf; median cells linear-vermicular 0.080-0.125 mm. in length, 10-16 : 1; basal cells shorter and broader, extreme alar sometimes inflated and vesicular with a single row of much enlarged rectangular cells along the base (these frequently fail to be detached with the leaf); stem leaves of lower stems slenderly deltoid-ovate, auricled and decurrent (the auricles are often made more distinct by strong plicæ near the margin, as in *Climacium americanum*), 2-2.5 mm. long and about one-half as wide as the widest portion of the base; median and basal cells as in the branch leaves; auricular cells rectangular to hexagono-rhomboidal, the lower somewhat inflated and vesicular; perichaetial leaves sheathing, with long squarrose filiform apices, entire or distantly dentate above, ecostate or rarely with traces of a costa. Dioicous apparently; no male buds found. Seta 3-4 cm. long, red, becoming red-brown when old, very rough, very little or not at all twisted; capsule oblong-cylindric, arcuate and inclined, to nearly horizontal, with operculum about 3.5 mm. long, about 4 : 1, somewhat contracted under the mouth when dry; operculum conic and rostrate with a shining black, needle-like beak about one-third the height of the entire operculum; annulus inconspicuous, of a single row of cells; teeth red; segments slender, widely open along the keel, from a basal membrane about one-half their height, cilia two or three, well developed but shorter than the segments, nodose or slightly appendiculate; spores about 0.013 mm., shrunken and apparently immature on date of collection, November 23, 1890.

Type locality, moist banks, Mason county, Washington. G. V. Piper, No. 25, Nov. 23, 1890. Pl. 10.

Type in Eaton Herbarium at Yale. Co-type in Herbarium of Columbia University.

Washington, British Columbia, not rare. Idaho. Leiberg.

EXSICCATI.—Grout, N. Am. Musc. Pl. 162. 422.

Closely related to *B. asperrium* and *B. lamprochryseum*, differing from both in its almost regularly pinnate branching and auriculate stem leaves; also from the former in the narrower, more strongly plicate stem leaves, branch leaves not decurrent, and in the longer, more slender, and more arcuate capsule. From the latter it also differs in the more slender habit and narrower, less plicate stem leaves. *B. asperrium* and *B. Washingtonianum* are characterized by an operculum abruptly rostrate when dry, with a slender black shining beak, the operculum itself being some shade of brown. This is well illustrated in Sullivant's figures of *B. asperrium*, Icones Musc. Suppl., pl. 76. When moist, this operculum becomes long-conic and rostrate, as shown in the plate. Taken by itself, this species might be referred to *Eurhynchium* or *Camplothecium*, but it is certainly more closely related to *B. asperrium* and *B. lamprochryseum* than to any other species. The capsules of *B. asperrium* in Sullivant's figures are more slender than is the rule in a large series of specimens examined. Pl. 10.

BRACHYTHECIUM RIVULARE Br. & Sch. Bry. Eur. fasc. 52-54. pl. 546. 1853.

Plants variable but usually very robust, in wide thick mats, dark green to yellow-green; stems woody, creeping, filiform, leafless when old, distantly foliate with small leaves when young; secondary stems typically somewhat dendroid, stout, ascending-arcuate, 3-6 cm. long, nearly free from branches below, irregularly branching above; branch leaves ovate to ovate-lanceolate, somewhat decurrent, reaching 1.5×0.6 mm.,

acute to short-acuminate, dentate above with small sharp pointed teeth, strongly concave and often somewhat plicate; margins plane or slightly reflexed below; median cells 10-15 : 1; basal broader and shorter; extreme alar cells abruptly enlarged; leaves of secondary stems very characteristic, distant, broadly ovate, rather abruptly short acuminate, reaching 2×1.4 mm., concave, more or less plicate, denticulate; costa often forking; median cells 8-10 : 1; alar cells abruptly enlarged and inflated. Dioicous. Seta 1.5-2 cm. long, red-brown, very rough; capsule 2-3 by 1 mm., oblong-ovoid, unsymmetric to arcuate, inclined or horizontal; peristome perfect; spores maturing in early autumn.

Common on stones in bed of brooks and in other places that are always moist and are occasionally submerged but not always under water. The broad, short-pointed leaves of the secondary stems and their enlarged and inflated alar cells are characteristics which readily distinguish this species in all its protean forms.

On moist ground near the edges of water it becomes glossy yellow-green, approaching *B. salebrosum* in appearance; growing in quiet streams it often becomes long, slender, and almost floating, the secondary stems reaching a length of 10 cm. or more. Another form will have the secondary stems simple and long flagelliform. Like *B. oxycladon* this species is imperfectly dioicous. There is some evidence that plants bear antheridia one year and archegonia the next.

Type locality European.

Northern U. S. & Canada across the continent, south to Virginia and Missouri; not yet reported from the west coast of the U. S.

ILLUSTRATIONS.—Bry. Eur. 1. c.; M. H. M. 281.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 377, (Ed. 2) 505; Aust. Musc. Appal. 319, 320, 321 and 317 (as *B. rutabulum*); R. & C. Musc. Am. Sept. Exsic. 244; Grout N. Am. Musc. Pl. 9, 114, 241, 298, 403, 441 var.; Musci Perfecti 28.

Var. CATARACTARUM Sauter, Fl. Hertzog. Salzburg 3: 60. 1870.

Floating, dark green to golden green, brown underneath; secondary stems much elongated, simple or sparingly branched; branches short, directed forward at an acute angle; leaves much more closely imbricated, especially at the tips of the branches.

On timbers of an old dam, Staley's creek, Virginia; sterile (Dr. J. K. Small).

Var. LAXUM Grout, Bryologist 4: 48. July 1901 (Fig. 1).

Plants very lax, sparingly branched; leaves more loosely areolate than in typical forms; all but the lowest slenderly acuminate as in *B. rutabulum* but having the alar cells of this species. In habit this resembles robust forms of *Calliergon cordifolium*. Sterile and doubtfully assigned to this species. Avalanche Trail, Flathead Co., N. W. Montana, J. M. Holzinger and J. B. Blake.

EXSICCATI.—Grout, N. Am. Musc. Pl. 78.

Var. LAMOILLENSE Grout, Bryologist 7: 44. May 1904.

B. rivulare tenue Grout, Bryologist 7: 34. March 1904.

Varying toward *B. Nelsoni*; prostrate or ascending, irregularly branched, slender, very light glossy yellow; lower leaves distant, often spreading, the upper closely imbricated giving the plants the appearance of *B. oxycladon*; stem leaves acuminate with a rather short slender point. Type from Lamaille Cave, Minnesota. Holzinger.

EXSICCATI.—Grout N. Am. Musc. Pl. 200.

In the swampy lands near the coast and possibly in other localities there occur numerous forms intermediate between *B. rivulare* and *B. rutabulum*. Some of these are very puzzling and have suggested hybrids to me. One of these forms was named *B. noveboracense* by me and described in the Bryologist 3: 36 (12), 1900, but the peculiar capsules of the specimens described I believe to have been freakish and unusual. It is probably nearer *rutabulum*. The alar cells are larger and the leaf apices shorter as a rule. The leaf apices are longer and alar cells smaller than is usual in *B. rivulare*. The leaf characters are somewhat intermediate between these two species and those of *B. Starkei*, but the stem leaves are longer and ovate rather than deltoid ovate. The stem leaves are more distant than in any of the related species, reminding one of *Hypnum cordifolium*.

BRACHYTHECIUM NELSONI Grout, Bryol. 5: 76. Sept. 1902.

Plants with the facies of undersized *B. rivulare*, but not dendroid; stems 5-8 cm. long, irregularly to subpinnately branching; stem leaves erect-spreading, triangular-ovate, slenderly long-acuminate, about $1.5-2 \times 0.6$ mm., slightly concave with margins turned inwards towards the apex, slightly serrulate at extreme apex; branch leaves similar to the stem leaves but smaller and usually proportionately narrower, the upper often serrate above, decurrent, with a large area of abruptly enlarged and inflated alar cells which are separated from the ordinary cells by a narrow band of much smaller oblong cells. These alar cells are much like those of *B. rivulare*, except that they occupy a larger area; median and apical cells much as in *B. rivulare*, costa stout at base, rapidly narrowing in the lower portion, extending about two-thirds the length of the leaf; perichaetial leaves slightly costate. Apparently dioicous. Sporophyte not differing essentially from that of *B. rivulare*. Pl. 10.

La Plata Mines, Wyoming, Aug. 25, 1898. Coll. Elias Nelson, no. 5172. Com. J. M. Holzinger. Apparently growing on humus. Type in herb. A. J. G.

This plant is very close to *B. rivulare* but differs distinctly in its triangular long-acuminate leaves, which are different from any I have examined. The inflated alar cells are also much more numerous, extending well toward the costa.

I found it very common in the Rocky Mountains in the vicinity of Tolland, Colorado.

BRACHYTHECIUM PLUMOSUM (Sw.) Br. & Sch. Bryol. Eur. fasc. 52-54. pl. 537. 1853.

Hypnum plumosum Sw. Disp. Musc. Suec. 66. 1799. Not Huds. or Hedw.

Hypnum pseudo-plumosum Brid. Musc. Rec. 2: 108. 1801.

Hypnum flagellare Hedw. Sp. Mus. 282. pl. 73, f. 1-3. 1801, (fide Limpricht). Not Dicks.

Hypnum chrysostomum Mx. Fl. Bor. Am. 2: 319. 1803, (fide Limpricht).

Brachythecium rutabuliforme Kindb. Macoun, Cat. Can. Pl. 6: 198.

Eurhynchium semiasperum, Kindb. Macoun, Cat. Can. Pl. 6: 207. 1892.

Plants robust, in wide loosely-intricate mats, brownish-green to golden-green, usually glossy on the surface, brown underneath; stems 3-6 cm. long, creeping, subpinnately branching, clinging closely to the substratum at the borders of the mats; branches ascending or erect, straight or somewhat curved, 5-10 mm. long; branch leaves equally spreading or somewhat secund, rather loosely erect-spreading, lanceolate to broadly ovate-lanceolate, long-acuminate, 1.1-1.5 × 0.4-0.5 mm., serrate to serrulate above, sometimes nearly entire; costa extending $\frac{3}{4}$ the length of the leaf; median cells linear, 8-12 : 1; a few basal cells broader and shorter; quadrate alar cells few, thick-walled and opaque; stems leaves often somewhat decurrent, narrowly triangular-ovate to broadly ovate, acuminate, more loosely areolate, nearly entire to serrate above; perichaetium 1.5-2 mm. long; leaves sheathing, with spreading points, oblong-ovate to oblong-lanceolate, rather abruptly narrowed to a long slender acumination, nearly entire, more or less distinctly costate. Monoicous; male branches abundant. Seta 7-20 mm. long, dark red-brown to almost black, rough above, nearly smooth below; capsule chestnut-brown, black when old, oblong-ovoid, 2.2-2.5 mm. long; 2.5 : 1, horizontal to suberect, nearly symmetric or slightly curved, slightly contracted under the mouth when dry; operculum conic, almost rostrate; annulus narrow, of a single row of cells; segments short, about equaling the high basal membrane; cilia 2 or 3, well developed, appendiculate; spores nearly smooth, 13-16 μ , maturing in late autumn.

Type locality European.

Subaquatic, on moist rocks in woods and in brooks, especially in mountain regions. Northeastern United States and Canada; west to Minnesota; British Columbia; south to Fla., Underwood.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. 283.

EXSICCATI.—Sull. Musc. Allegh. 40; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 332, (Ed. 2) 496 and 498; Austin, Musc. Appal. 325, 326, 327; Macoun, Can. Musc. 289; R. & C., Musc. Am. Sept. Exsic. 110; Grout, N. Am. Musc. Pl. 10, 449, Musci Perfecti 88.

Distinguished from most of the species by having the seta smooth below and rough above; from *B. campestre* by having the leaves shorter, more abruptly pointed, nearly entire and not plicate; from *B. populeum* by the shorter costa, which does not extend into the apex; all the accessible descriptions speak of the perichaetial leaves as ecostate, but the perichaetial leaves of Limpricht's Bryol. Sil. 242 and Husnot's Musc. Gall. 277a were very conspicuously costate and such was the case in all the American specimens examined. Specimens of *B. rutabuliforme* from the type collection have the seta nearly smooth below instead of very rough and are certainly referable to *B. plumosum*.

Var. HOMOMALLUM Br. & Sch. l. c. Branches curved at apex, leaves falcate-seund, smaller. With the ordinary form.

EXSICCATI.—Sull. Musc. Allegh. 41 *Hypnum pseudoplumosum*; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 332b, (Ed. 2) 497.

Var. PRINGLEI (Williams) Grout, Bryologist 5: 41. May 1902.

B. Pringlei Williams, Bull. Torr. Bot. Club 29: 67. pl. 4. Feb. 1902.

An extremely large form with leaves reaching 2.5 × 1.5 mm., secund, long-decurrent, broadly ovate, short acuminate, entire or slightly serrulate. Immature capsules somewhat unsymmetric and suberect.

Type from Huachuca Mts., Arizona, July 1884. C. G. Pringle.

The nature of the basal and alar cells and the seta papillose in the upper part only, clearly indicate the relationship of this form.

Homomallous leaves are very common in this species. Dixon states it is difficult to find English plants from which they are completely absent.

Var. ROELLII (R. & C.) n. comb.

B. Roellii R. & C. Bot. Centralbl. 44: 422. 1890.

Leaves more strongly serrate, more strongly decurrent. "Dioicous."

Type locality. Vancouver.

Type material from Cardot seen.

BRACHYTHECIUM POPULEUM (Hedw.) Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 535 and 536. 1853.

Hypnum populeum Hedw. Sp. Musc. 270. *pl.* 70, f. 1-6. 1801.

Hypnum Stereodon Laureri Funck. Brid. Bryol. Univ. 2: 595. 1827 (*vide* Limpricht).

Hypnum saxicola Voit; Sturm, Deutschl. Fl. 2: fasc. 12. 1812.

Brachythecium nanopes C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 201. 1892.

Plants in wide, loosely intricate mats, dark green to yellowish green; stems 2-5 cm. long, creeping, stoloniferous, attached to the substratum by dense fascicles of radicles, subpinnately branching; branches 3-10 mm. long, terete-foliate; branch leaves erect-spreading; the upper lanceolate, the lower broadly ovate-lanceolate, 1-1.2 × 0.25-0.4 mm., slightly decurrent, subulate-acuminate, more or less concave, nearly entire or finely serrate above; margins revolute below; costa stout, extending into the apex, nearly or quite percurrent; median leaf-cells linear-oblong, 5-8 : 1; several rows of basal and alar cells rhomboidal to quadrate; stem leaves 1.4-1.8 × 0.5-0.6 mm., broadly ovate, slenderly acuminate with apex usually more or less contorted, nearly entire, not plicate or sulcate; leaf-cells broader and shorter; perichaetium 1.5-2 mm. long; the leaves sheathing at the base, with spreading points, oblong-lanceolate, rather abruptly narrowed to a subfiliform acumination, entire or slightly serrate above; costa well developed. Autoicous. Seta 10-12 mm. long, red-brown, roughened above with low broad papillae, nearly smooth below, (sometimes nearly smooth throughout); capsule brown, short-ovoid, unsymmetric, horizontal, 2 : 1; operculum very long-conic; annulus persistent, of a single row of cells; segments as long as the teeth, split between the articulations; cilia stout, variable, 1-3, more or less appendiculate; spores finely roughened, about 15 μ, maturing in early winter.

Type locality European.

On stones, roots and trunks of trees, rarely on soil, northeastern United States and Canada; Revelstoke, B. C.; North Carolina; Minnesota.

ILLUSTRATIONS.—Br. & Sch. l. c.; M. H. M. 285.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 333, (Ed. 2) 499. Austin, Musc. Appal. 328; Macoun, Can. Musc. 441, 548 (*B. nanopes*); Grout, N. Am. Musc. Pl. 38.

Quite variable in size and shape of leaves and robustness of growth. Distinguished by its long-conic operculum, percurrent costa and partially roughened seta.

Var. MAJUS Br. & Sch. l. c. *pl.* 536.β.

Stouter, glossy, nearly bronze-colored, densely foliate, leaves longer; habit of *B. plumosum*.

Var. RUFESCENS Br. & Sch. l. c.

Mats depressed, closely adhering to the substratum; branches short, numerous, erect or ascending; stem leaves appressed, shorter and narrower, broadly lanceolate; bronze-colored, seta shorter.

On rocks, New Haven, Ct. (Pease).

Var. OVATUM Grout Mem. Torr. Bot. Club 6: 190. 1897.

Often having the appearance of var. *rufescens*, but with the stem leaves broadly cordate-ovate, 1.4 by 0.8 mm., concave, margins reflexed below, rather abruptly narrowed to a much shorter subulate acumination; costa very stout, often ending below apex; branch leaves ovate-lanceolate, median cells 5 : 1.

On dry rocks in woods with *Grimmia apocarpa*. Johnson and Peacham, Vt.; Indian Falls, Owen Sound; New Harbor, Newfoundland. Probably a habitat form, as it grows on dry rocks instead of moist.

EXSICCATI.—Grout, N. Am. Musc. Pl. 4.

ILLUSTRATION.—M. H. M. l. c.

BRACHYTHECIUM REFLEXUM (Starke) Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 539. 1853.

Hypnum reflexum Starke, Web. & Mohr. Bot. Taschenb. 306 and 476. 1807.

Leskea laxifolia Hook. Musc. Exot. *pl.* 30. 1818.

Hypnum laxifolium Schwaegr. Musc. Frond. Suppl. 2: 159. *pl.* 143. 1824. Lesq. & James, Man. 342. 1884.

Hypnum subtenue James, Proc. Acad. Phila., 1855: 447. 1855.

Plants in wide, loosely intricate, dark green mats (occasionally yellow-green in sunny places); stems filiform, 5-10 cm. long, arcuate-procumbent, radiculose at points of contact with substratum, pinnately branching; branches filiform, about 5 mm. long, ascending, terete-foliate, attenuate at apex, not radiculose; branch leaves erect-open, loosely appressed-imbricate when dry, lanceolate, decurrent, 0.6-0.9 × 0.25-0.4

mm., gradually acuminate, serrate above, slightly concave; costa stout, extending into apex; median cells oblong-rhomboidal to oblong-hexagonal, 3-5 : 1; quadrate alar cells very numerous, extending up the sides of the leaf; stem leaves 0.8-1.2 \times 0.5-0.8 mm., deltoid-ovate, long-acuminate; acumination equaling $\frac{1}{2}$ to $\frac{1}{2}$ entire length of leaf. Perichaetium 2 mm. long; leaves sheathing at base, with spreading tips; inner leaves oblong-ovate, long-acuminate, entire or serrate at apex, nearly ecostate. Monoicous. Seta 10-15 mm. long, red-brown, very rough, twisted to the right below and usually to the left above; capsule red-brown to nearly black when old, 2 mm. long, 2 : 1, ovoid, horizontal, not constricted under the mouth when dry; operculum conic, apiculate; annulus of two rows of cells; cilia 2 or 3, stout, appendiculate; spores nearly smooth, 15-18 μ , maturing in autumn or early winter.

Type locality European.

On decaying logs, roots of trees and detritus of siliceous rocks. Mountains of northern United States and eastern Canada; west to Lake Huron and Montana; Maryland.

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, *Musc. Gall. pl. 94*; Rab. *Krypt. Fl. 4^e: f. 373*; M. H. M. 282. EXSICCATI.—Sull. & Lesq. *Musc. Bor. Am. (Ed. 2) 503*; Austin, *Musc. Appal. 540*; Macoun, *Can. Musc. 286*; Grout, *N. Am. Musc. Pl. 202*.

Limpricht l. c. states that the spores are papillose but I have been unable to find rough spores in either European or American material. Easily distinguished from the other American species by its filiform stems and branches and the areolation of the leaves approaching that of *Amblystegium*.

Hooker's type of *Leskea laxifolia* from the Northwest Coast (Menzies) has been seen and Dr. Best, Mrs. Britton and myself are agreed that it is this species.

BRACHYTHECIUM GLACIALE Br. & Sch. *Bryol. Eur. fasc. 52-54. pl. 542. 1853.*

"Much resembling *B. Starkei*; differing in its short, obtuse, *julaceous branches*, with the leaves *closely imbricated, not spreading nor distant, narrower, widely ovate-lanceolate, not cordate*, decurrent, plicate; branch-leaves narrower and more longly acuminate; areolation as in that species. Perichaetial bracts imbricated, erect. Seta short, rough. Capsule shortly oblong, turgid. Cilia of inner peristome *nodulose, rarely appendiculate*. Autoicous."

Type locality European.

ILLUSTRATIONS.—Br. & Sch. l. c.; Husnot, *Musc. Gall. pl. 94*; Rab. *Krypt. Fl. 4^e: f. 372*; *Pl. 8*. Macoun, *Can. Musc. 735a*, from earth and rocks, Cape Breton Id., Nova Scotia is the only American specimen of this species that I have seen.

"The well-marked forms of *B. glaciale*, as I gathered it about the snow-line in Norway and the Pyrenees, are very distinct in the terete, *julaceous branches* with erect, striate leaves, from the ordinary forms of *B. Starkei*, in which the leaves are much looser, not appressed nor *julaceous*, and the habit is more straggling. The apparently clear distinction vanishes, however, when one comes to examine a series of plants, and is compelled to recognize the existence of intermediate forms. When in fruit the perichaetial bracts, erect in *B. glaciale*, spreading at the points in *B. Starkei*, appear to give a good distinguishing character."

No two European authorities seem to agree in their descriptions of this species and as a consequence the material in herbaria is much mixed. Consequently I have quoted the description and part of the notes of Mr. H. M. Dixon, in whose judgment I have great confidence. However, the authors of the species described the leaves as "*erecto-patentia*." For further distinctions see under *B. pacificum*.

BRACHYTHECIUM BESTII nomen nov.

Brachythecium pacificum (R. & C.) Grout, *Pub. Puget Sd. Biol. Sta. 3^{es}: 54. 1921.*

B. reflexum pacificum R. & C. *Bot. Centralb., No. 51. 1890.*

Eurhynchium pacificum Kindb. *Eur. & N. Am. Br. 101. 1896.*

More slender than *B. glaciale*, more robust than *B. reflexum*, with more closely appressed stem leaves ovate-lanceolate, scarcely triangular; leaf cells rather more than twice as long, median reaching 80-90 μ ; "angular cells rectangular seldom quadrate"; costa generally vanishing in the base of the acumination, sometimes percurrent. *Pl. 12.*

Pacific coast, Oregon to Alaska. Cardot gives several stations from Alaska. Cape Breton Id., *No. 1432, 1915*, and also *No. 99* of 1909, G. E. Nichols. Traill River Divide, Idaho, alt. 7,000 ft., "On shady crevices of quartzite ledges, J. B. Leiberger, *No. 260*" White Bay, Newfoundland, 10-6-91. Sent by Dr. Best, probably collected by Wagborne.

Up to the year 1919 I had confused this moss with *B. glaciale* Br. & Sch. Others here and abroad had confused it with *B. reflexum* (Starke) Br. & Sch. and *B. Starkei* (Brid.) Br. & Sch.

This group, including *B. reflexum*, *B. glaciale*, *B. Starkei*, and *B. pacificum*, has puzzled bryologists for a long time, not only in America but also in Europe. Part of my bewilderment is attributable to a specimen

from Greenland, ex-herb. Schimper, communicated by Cardot, as *B. glaciale*, which is not that species, but a very robust form of *reflexum* approaching *Bestii* or, possibly, it may be near the var. *micropus* (*B. micropus* B. & S.).

Although I have not studied the calyptra and peristome of these forms from North America, forms of *B. reflexum* approaching *micropus* in gametophyte characters are not rare in North America. They run larger in size and have the leaves less abruptly acuminate, with leaf-cells longer and narrower.

B. Starkei is the most robust of the group, with leaves spreading, scarcely plicate, of tenalmost complanate, very widely cordate-ovate. *B. glaciale* is more slender, julaceous, with leaves appressed, somewhat plicate, with the costa perhaps averaging a little longer than in *B. Starkei*, but this is not constant.

B. pacificum is much more slender than *B. glaciale*, approaching *B. reflexum* in habit, but with leaves less closely appressed when dry, costa longer and stronger than in *Starkei* or *glaciale*, but not consistently percurrent. Leaf-cells much like those of *Starkei* in outline, but smaller.

B. reflexum is typically very slender, almost filiform, with widely cordate-ovate leaves, abruptly long-acuminate, leaf-cells much as in the shorter-celled *Amblystegia*, typically about 5 : 1 in the stem-leaves.

According to Braithwaite, Bottini considers *B. reflexum micropus* a hybrid with *B. populeum*. There is much to suggest hybrids in the varying and intergrading species of this group. *B. Starkei* and *B. reflexum* are common in the mountain regions of North America, apparently less frequent westward. I have *B. Bestii* from Norway, communicated by Holzinger.

ILLUSTRATION.—Proc. Wash. Acad. Sci. 4: pl. 23, f. 4a-c; Pl. 12.

Named in honor of Dr. G. N. Best.

Jennings (see *B. subsperrimum*) used the name *pacificum* for a species of *Brachythecium* before I published Cardot's variety as a species. Thus *Brachythecium pacificum* became a synonym and will have to be discarded, as least in so far as this species is concerned.

BRACHYTHECIUM STARKEI (Brid.) Br. & Sch. Bryol. Eur. fasc. 52-54. pl. 541. 1853.

Hypnum Starkei Brid. Musc. Rec. 2^o: 107. 1801.

Eurhynchium pseudoserrulatum Kindb. Ottawa Nat. 7: 22. 1893.

Plants in wide, loose mats, dark green, seldom whitish-green; stems irregularly divided, pinnately branching, decumbent or ascending, often stoloniferous, arcuate and rooting at the tips; branches 5-20 mm. long, ascending and arcuate at the ends, more or less complanate-foliate; middle branch leaves distant, spreading, ovate-lanceolate, 1.4-1.7 × 0.7-0.9 mm., narrowly acute to acuminate, with apex often twisted, somewhat decurrent, strongly serrate, not plicate or sulcate when moist; costa extending beyond the middle; median cells linear-fusiform, 13 : 1; basal shorter and broader; a few of the alar cells rhomboidal to quadrate; stem leaves broadly ovate, broadly long-acuminate, less strongly serrate, more loosely areolate with a much larger area of rhomboid-quadrate cells at the base and alar angles; perichaetium 2.5 mm. long; leaves loosely sheathing, with squarrose points; inner leaves oblong-lanceolate, gradually long and narrowly acuminate, costate, nearly entire; outer leaves shorter, ecostate. Monoicous. Seta 2-2.5 cm. long, red-brown, roughened with large distinct papillae; capsule oblong-ovoid, dark red-brown, 2-2.5 mm. long, ½ as thick, strongly arcuate, horizontal, slightly narrowed under the mouth when dry; operculum conic; annulus of about two rows of cells; segments a little shorter than the teeth; cilia 2 or 3, appendiculate; spores nearly smooth, about 14 μ, maturing in winter.

Type localities European.

On decaying logs and stumps in moist mountain regions. Northern United States and Canada across the continent; Vancouver Island; Montana; south to New Jersey and Pennsylvania.

ILLUSTRATION.—Br. & Sch. l. c.; Pl. 8.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 336, (Ed. 2) 504; Austin, Musc. Appal. 323; Grout, N. Am. Musc. Pl. 62.

Fragmentary specimens of *Hypnum oedipodium* Mitt. (Journ. Linn. Soc. 8: 32. 1865) of the type collection and from both the localities cited in the original description have been examined and could not be differentiated from the ordinary American *B. Starkei*. Specimens of *B. curtum* Lindb. identified by Lindberg himself, have been accessible through the kindness of V. F. Brotherus. The costa of the upper branch leaves was often found ending in a spine, and the cilia were also appendiculate. I have thus far been unable to differentiate *B. curtum* from *B. Starkei* in either American or European material. All the characters given as distinctive are quite variable, even on the same plant in many cases. The majority of the specimens of *B. Starkei* from northeastern North America are more loosely intricate and straggling than the typical European plant, they are also markedly complanate-foliate and the costa often ends in a spine and is toothed on the back above. These forms are probably referable to var. *complanatum* Limpr. l. c.

BRACHYTHECIUM VELUTINUM (L.) Br. & Sch. Bryol. Eur. fasc. 52-53. pl. 538. 1853.

Hypnum velutinum L. Sp. Pl. 358. 1753.

Hypnum intricatum Schreb. Sp. Flor. Lips. 1771.

Hypnum declivum Mitt. Journ. Linn. Soc. 8: 33. pl. 6. 1865.

Brachythecium pseudo-erythrorrhizon Kindb. Hedwigia, 35: 68. 1896.

Plants in wide, dark green to light yellowish-green mats; primary stems about 5 cm. long, creeping, radiculose with fascicled radicles, irregularly divided, very sparingly leafy, leaves often reduced or even wanting in places, branching irregularly pinnate; branches short, 2-5 mm. in length; branch leaves loosely spreading, somewhat falcate-secund at the ends of the branches, lanceolate to ovate-lanceolate, $1-1.3 \times 0.25-0.30$ mm., gradually long-acuminate; apex usually falcate or twisted; margin serrate; costa extending beyond the middle, often toothed above on the back; median cells linear, 12 : 1; quadrate alar cells very few, confined to the extreme angles; stem leaves more narrowly lanceolate, usually longer acuminate, often much reduced in size; perichaetium 2 mm. long; leaves few, sheathing at base, the inner oblong-ovate, rather abruptly narrowed to a long acumination, sharply dentate above; costa wanting or short and slender. Monoicous. Seta 15 mm. long, light brown, sometimes reddish, very rough, slightly or not at all twisted; capsule brown, short-oblong, arcuate, horizontal, contracted under the mouth when dry, 2-2.5 mm. long, 2-3 : 1; operculum conic; annulus large, easily detachable; segments lanceolate, as long as the teeth, attached to a basal membrane of medium width, more or less split along the keel; cilia 2 or 3, nodose or subappendiculate; spores yellow-brown, minutely roughened, 10-13 μ , maturing in autumn, winter, and early spring in New England.

Type locality European.

On earth or stones and trunks of trees at the base, in shady places. Northern United States and Canada, south to New Jersey; Calif. (Howe).

ILLUSTRATIONS.—Dill. Hist. Musc. pl. 42, f. 61; Br. & Sch. l. c.; M. H. M. 286.

EXSICCATI.—Sull. & Lesq. Mus. Bor. Am. (Ed. 2) 500; Austin, Musc. Appal. 324; Macoun, Can. Musc. 379; Grout, N. Am. Musc. Pl. 60, 409.

Varying a great deal in robustness, roughness and length of seta and color of capsule, capsule often yellow-green. "A very variable species, plants slender or robust; stems more or less divided, and the branchlets varying in length; leaves close or more distant, bright green or yellow, opaque or glossy; capsule subglobose or oblong, on a short or long pedicel." Lesq. & James, Mosses of N. A., p. 340. *B. pseudo-erythrorrhizon* Kindb. is inserted as a synonym on the authority of M. Cardot (*vide* Hedwigia 35: 308, 1896), as no specimens have been accessible.

BRACHYTHECIUM PETROPHILUM Williams, Bull. N. Y. Bot. Garden 2: 136. 1901.

"In low, dense tufts or sometimes in thin mats with long creeping stems and short subpinnate branches. Stem leaves 1.5 mm. long by .4 mm. wide, narrowly ovate-lanceolate, about one-half costate, serrulate all round, more or less decurrent and margin reflexed near base, not very concave and scarcely or not plicate. Median leaf-cells linear-flexuous, up to .065 mm. long and .005 mm. wide. Alar cells short and broad, not forming a distinct cluster. Branch leaves very similar to stem leaves but mostly a little smaller, with longer costa ending in spine on back and adjacent cells sometimes papillose by the projecting upper ends. Inner perichaetial leaves pale, ecostate, gradually narrowed to a slender, flexuous, serrulate point, with rarely 1 or 2 coarse teeth at base. Capsule nodding, curved, with lid about 2.5 mm. long and 1 mm. broad. Lid conical, its height about equal to basal diameter. Annulus of two rows of cells. Teeth of peristome hyaline-bordered, papillose above, outer plates striate, inner lamellae about 30, segments without rounded perforations, more or less split along the keel with mostly 2 appendiculate cilia between. Seta rough throughout, up to 1.2 cm. high. Smooth spores up to .011 mm." Pl. 7.

"Dawson, on rock. In good fruit June 24, 1898. (722.)"

William's original description is given. He states it is nearest *B. suberythrorrhizon* but "differs in rough pedicel, leaves narrower, less serrate and plicate and cilia appendiculate" I still think as previously stated (Bryologist 5: 41) that it is nearer *B. Thedenii*, from which it differs in its more crowded shorter acuminate not falcate leaves with fewer quadrate alar cells and the rough seta. But in the *velutinum-collinum* group the roughness of the seta is variable. The spinose costa and papillose leaf cells are very little in evidence and rarely observed.

Bartram finds a form of what seems to be the same thing in Arizona. The leaves are narrowly lanceolate and seta less roughened, but as rough as one seta I found in Williams type collection. This I have called forma *LANCEOLATA*. A form very close to this was collected by Bailey at Menastash Canyon, Ellenberg, Washington and was issued as no. 476 of my N. Am. Musci Pleurocarpi.

BRACHYTHECIUM LEIBERGHII Grout, Mem. Torr. Bot. Club 6: 197. 1897.

Plants in wide densely intricate green mats; stems decumbent or ascending, 3-5 cm. long, pinnately branching; branches 5-10 mm. long; branch leaves falcate-secund, decurrent, 1.2×0.4 mm., lanceolate,

bisulcate or often plicate, gradually very slenderly acuminate, serrate, costate to beyond the middle; median cells fusiform, 8-10 : 1; basal shorter and broader; quadrate alar cells numerous; stem leaves ovate to ovate-lanceolate, more strongly plicate; perichaetium 2.5 mm. long, loosely sheathing; leaves oblong-ovate, abruptly filiform-acuminate, nearly ecostate. Monoicous. Seta 1.5-2 cm. long, red-brown, roughened with rather low blunt papillae, little twisted; capsule light brown, 1.5 mm. long, 1.5-2 : 1, short-ovoid, unsymmetric, horizontal; operculum short conic; annulus present; segments as long as teeth, cilia two or three, well-developed, appendiculate; spores smooth, 10-12 μ , maturing in winter or early spring.

Type locality, summit of "Bareknob" Traill River Basin, Idaho, alt. 5500 ft. (J. B. Leiberg, 288. July, 1891).

Washington, frequent; Montana; Idaho; Colorado, frequent.

The gametophyte closely resembles *B. erythrorrhizon*, from which it differs in the rough seta and in being monoicous. Easily distinguished from *B. velutinum* by the larger stem leaves.

EXSICCATI.—Allen, Mosses of Cascade Mts. 105a, 105b.

BRACHYTHECIUM COLLINUM (Schleich.) Br. & Sch. Bryol. Eur. fasc. 52-54, pl. 548. 1853.

Hypnum collinum Schleich. Cat. 1815.

Leskea Fendleri Sull. Mem. Am. Acad. 4: 169, pl. 1. 1849.

Hypnum Fendleri Sull. Icon. Musc. 189, pl. 117. 1864.

Brachythecium Hillebrandi Lesq. Mem. Calif. Acad. 1: 33. 1868.

Plants small, slender, in thin intricate mats, bright green and glossy above, often dirty green below; stems creeping, radiculose, much branched; branches erect, slender, usually julaceous, often subdivided, 3-6 mm. long, terete-foliate; branch leaves closely imbricate, ovate to broadly ovate-lanceolate, 0.3-0.5 \times 0.7-0.9 mm., rather abruptly acuminate, serrulate at base, sharply serrate above, concave; costa extending to middle; median cells linear-oblong to fusiform, 3-6 : 1; quadrate alar cells numerous, usually chlorophyllous, extending up the margin; stem leaves broadly ovate; perichaetium 1.8-2 cm. long; inner leaves oblong-ovate, abruptly narrowed to a slender acumination, serrate; costa thin and short or wanting. Monoicous. Seta 5-12 mm. long, yellow-brown, smooth or slightly roughened; capsules brown, ovoid, unsymmetric to arcuate, contracted below the mouth when dry, 2 mm. long, 2 : 1; operculum conic; annulus broad, of two rows of cells, easily detached; the segments as long as the teeth, lanceolate, attached to a basal membrane of medium width; cilia well developed, one or two, with sometimes rudiments of a third, nodose; spores yellow-brown, very nearly smooth, 10-12 μ , maturing in autumn.

Type locality European.

On earth and rocks in mountains of western United States and Canada; Peace River, Mt. Shasta, Colorado, Montana, New Mexico, and intermediate points; Greenland (Fl. Gr.).

ILLUSTRATIONS.—Br. & Sch. l. c.; Sull. l. c.; Pl. 9.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 501, (*Hypnum Fendleri*); Macoun, Canadian Musci, 398; Röll 1540, 1540a, 1565a. Ren. & Card. Musc. Am. Sept. Exsic. 107; Grout, N. Am. Musc. Pl. 448, 498.

After a critical examination of two sets of Fendler's collection from the type locality of *Leskea Fendleri*, no valid distinction between this and *B. collinum* could be detected as the seta of *B. collinum* is usually slightly roughened in both European and American specimens. Also one capsule of Fendler's plant had two well developed cilia. No specimens of *Brachythecium Hillebrandi* of the original collection have been accessible and all the specimens examined which have been referred to this are undoubtedly *B. collinum*. There are no distinctions except the shorter capsule, rough seta and simple annulus. The length of capsule is always subject to considerable variation.

B. collinum frequently has a rough seta and the terms simple and compound, as applied to the annulus, have been used in a very loose way. As described and illustrated in recent literature the leaves of *B. collinum* are more abruptly acuminate, with a larger area of quadrate alar cells than that shown in the illustration from the Bry. Eur. pl. 548.

Var. IDAHENSE (R. & C.) n. comb.

B. idahense R. & C. Bot. Gaz. 15: 60, pl. 9, C. 1890.

More robust; leaves more or less falcate, less abruptly acuminate; median leaf cells longer, 6-8 : 1; quadrate alar cells rather more numerous. With the exception of the alar cells the Bry. Eur. plate illustrates this variety rather better than the typical form according to Limpricht. Widely distributed with the species.

Type specimens from Cardot himself seen and studied. This variety of *collinum* grades into *B. erythrorrhizon* through its var. *suberythrorrhizon* so that it is extremely difficult to delimit the species and varieties.

BRACHYTHECIUM UTAHENSE James, Bot. King Exped. 409. 1871.

Plants light green, loosely caespitose, small and slender; stems short, creeping, radiculose, irregularly branching; branches 3-5 mm. long; branch leaves pluriseriate, loosely imbricate, oblong-lanceolate to ovate-lanceolate, $0.9 \times 0.3-0.4$ mm., acuminate, serrulate below, serrate above, somewhat concave; margins slightly reflexed below; costa extending to the middle or beyond; median cells linear-fusiform, 6-9 : 1; quadrate alar cells numerous; perichaetium 0.8 mm. long; inner leaves serrate, acuminate from a broad sheathing base, ecostate. Synoicous; antheridia mixed with the archegonia. Seta about 5 mm. long, brown, smooth; capsules brown, subglobose to oblong-ovoid, erect, nearly or quite symmetric, 2 mm. long, 3 : 1; operculum long-conic; annulus obscure; segments linear-lanceolate, as long as the teeth; basal membrane comparatively narrow; cilia rudimentary 1 or 2; spores yellow-brown, very slightly roughened, 10-15 μ , maturing in winter.

Type locality, sandstone rocks overhanging a dry stream bed near Hanging Rock Station, Echo Canyon, Utah, alt. 6000 feet (Watson); also found at Bald Mt., western Montana (Watson); Arizona (Pringle).

ILLUSTRATIONS.—Sull. Icon. Musc. Suppl. *pl.* 73. *Pl.* 9.

Closely allied to *B. collinum* but easily distinguished by the erect capsule and rudimentary cilia.

BRACHYTHECIUM ERYTHORRHIZON Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 547. 1853.

Plants in wide, intricate mats, light green, somewhat glossy; stems slender, 4 cm. or more long, radiculose, pinnately branching, not stoloniferous; branches 3-8 mm. long, ascending, the longer often arcuate and decumbent; branch leaves erect-spreading, $1-1.5 \times 0.3-0.5$ mm., more or less falcate-secund, lanceolate to ovate-lanceolate, gradually long and narrowly acuminate, serrate above, often plicate, costate to above the middle; margins more or less reflexed; median cells linear-vermicular, 8-10 : 1; quadrate alar cells distinct; stem leaves larger, ovate- to ovate-lanceolate, plicate, nearly entire; perichaetial leaves loosely erect, ovate to oblong-lanceolate, narrowly long-acuminate. Dioicous. Seta 10-15 mm. long; red-brown, smooth; capsule red-brown, ovoid, unsymmetric and horizontal, 2 mm. long, 2-2.5 : 1; operculum conic, apiculate; annulus present; segments somewhat shorter than the teeth; cilia 1 or 2, well developed; spores 14-20 μ , roughened, maturing in autumn.

Type locality European.

Washington, Clealum Lake Ridge; Belt Mountains and Columbia Falls, Montana; Colorado; White Mountains; Newfoundland; New Brunswick; Whiteface Mt., N. Y.

ILLUSTRATIONS.—Br. & Sch. l. c. *Pl.* 9.

Careful comparison of this species with specimens of *B. harpidioides* C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 194, make it almost certain that the two are identical. Although Prof. Macoun assures me that the specimens sent are identical with Kindberg's types, the plant from New Brunswick is not the same as that from British Columbia which appears to be *B. erythrorrhizon*.

Var. SUBERYTHORRHIZON (R. & C.) n. comb.

B. suberythrorrhizon R. & C. Bot. Gaz. 19: 238. *pl.* 22, *B.* 1894.

Differs from the type in being monoicous and in its narrower shorter acuminate leaves. Type from Springdale, Boulder Co., Colorado.

Type seen and studied. *Pl.* 12.

BRACHYTHECIUM THEDENII Br. & Sch. Bryol. Eur. fasc. 52-54. *pl.* 17. 1853.

Stems 5-10 cm. long, slender and creeping, often stoloniferous; *branching regularly pinnate*; branch leaves lanceolate, long filiform-acuminate; perichaetial leaves very long filiform-acuminate. Seta distantly but distinctly papillose.

Errol Dam, Androscoggin River, N. H. (James); Ottawa, Macoun; Burnt Side Lake, Minn., Wood.

This is one of the rarest of mosses, found in Europe in Finland and Sweden only.

James' plant has been carefully compared with authentic European specimens and it differs chiefly in the larger leaves, which approach *B. erythrorrhizon*. The slightly scabrous seta is a character not heretofore noted, but it is quite conspicuous in specimens from Sweden which were identified by Schimper himself.

Schimper's figure exaggerates the serration of the perichaetial leaves.

BRACHYTHECIUM BOLANDERI (Lesq.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1877-78: 324.

Hypnum Bolanderi Lesq. Trans. Am. Phil. Soc. 13: 12. 1869.

Plants in wide, pale green mats; stems 3-5 cm. long, irregularly divided, creeping, subpinnately branching, sparsely radiculose; branches 3-6 mm. long, ascending, terete-foliate; branch leaves erect-spreading,

rather distant, ovate-lanceolate, gradually acuminate, $0.6-0.8 \times 0.25-0.3$ mm., serrate all around, not concave or plicate, costa extending beyond the middle; median leaf-cells rhomboidal-fusiform, $36 \times 6 \mu$: basal cells shorter and broader; quadrate alar cells few, a few shorter cells running up the margin; lower stem leaves smaller, less distinctly serrate, often nearly entire, upper reaching 1.2 mm., otherwise little different; perichaetium 2 mm. long, loosely sheathing; inner leaves oblong-lanceolate, long-filiform acuminate, serrate with a few distant teeth, costa slender or lacking. Dioicous. Seta 1-1.5 cm. long, red, very rough; capsule brown, 1.5-2 mm. long, 2 : 1, ovoid, unsymmetric, horizontal; operculum conic-apiculate; annulus large, compound; teeth of peristome red-brown below; segments a little shorter than the teeth, from a broad basal membrane; cilia 2, as long as the segments, nodose; spores nearly smooth, about 10μ , maturing in April.

Type locality, on shaded ground, Calif. (Bolander); also collected at Olema, Marin Co. (Howe).

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 502.

LITTLE KNOWN OR DOUBTFUL SPECIES

BRACHYTHECIUM PSEUDO-STARKEI Ren. & Card. Bot. Centralbl. 44: 423. 1890.

"Dioicous, loosely caespitose, green; stem erect or ascending, flexuous, laxly pinnate, branches elongate, attenuate: leaves not close, patulous, ovate-lanceolate, plicate, acuminate, acumen long, sometimes tortuous; margin generally serrate all around; costa extending into the acumen; cells linear-rhomboidal, elongate, attenuate, alar lax, soft, quadrate, hyaline: not fruiting."

Washington, (Röll.).

Evidently aquatic, very lax and distantly foliate, with the habit of an Amblystegium. Related to *B. rivulare* and *B. rutabulum*; distinguished from both by its slender habit; from the first by its more slender-pointed leaves; from the second by having the leaves plicate and the branch leaves shorter-pointed. Stem leaves 1.8-2 by 1 mm.; middle branch leaves 1.4 by 0.8 mm.

BRACHYTHECIUM CAVERNOSUM Kindb. Rev. Bryol. 22: 86. 1895.

"Differs from *B. rutabulum*: leaves very concave, plicate, recurved on both sides to the acumen; lower basal and alar cells small, green and not well defined; lid of the capsule longer apiculate or rostellate."

"Amer. Canada: White, com. Macoun."

BRACHYTHECIUM CALCAREUM Kindb. l. c.

"Resembles *B. intricatum* (*Hypnum* Hedw., *Brachythecium velutinum* (var.) Schimper) in the habit; differs from *B. laetum* (Brid.) Kindb. (non Schimp.), not occurring in Europe, in the entire stem-leaves, the larger alar cells and the shorter costa, from *B. salebrosum* also in the leaves curved or secund in dry state."

"Leaves crowded, long-acuminate and filiform-pointed, denticulate at the acumen or (the stem-leaves) nearly entire, more or less recurved, incurved falcate when dry, patent when moist; cells linear, the angular short, the alar ones few, much larger and hyaline. Stem-leaves with a broad base; costa short, mostly vanishing near the middle. Branch leaves narrow; costa nearly reaching to the acumen. Capsule small, arcuate; cilia not appendiculate; lid apiculate; pedicel smooth, about 1 centim. long. Tufts dense and radiculose, green and faintly glossy. Stem irregularly divided; branches not compressed; monoicous."

"Limestone rocks, Canada, Ottawa; 1892, Macoun." Macoun's 838a from the same locality, June 8, 1899, agrees with Kindberg's description except for the fact that the seta is slightly roughened as in *B. campestre*. It seems clear that this is merely a form of *campestre* with leaves unusually falcate-secund.

BRACHYTHECIUM FITZGERALDI (C. Muell.) R. & C. Rev. Bryol. 20: 17. 1893.

Hypnum (*Brachythecium*, *Cavernularia*) *Fitzgeraldi* C. Muell. Flora, 70: 224. 1887.

"Dioicous; tufts low, pulvinate, broad, yellow, loosely interwoven; stem with branches short, more or less parallel, slender, round-julaceous; branchlets very short, rather spreading, single: stem leaves closely appressed, when moist scarcely spreading with cordate base semi-circularly impressed, rather broad ovate, short-acuminate; more or less ventricose-concave on both sides of the narrow vanishing deeply canaliculate green costa; margin nearly plane, everywhere slightly denticulate; cells very narrow, long, pale yellow; alar cells many, small, hexagonal; fruit unknown."

Type locality Florida. Collected by Fitzgerald. Specimens not seen.

BRACHYTHECIUM HOLZINGERI Grout, Bryol. 25: 14. 1922.

The type from Sperry Glacier seems not to be a *Brachythecium* but an *Amblystegium*. Brinkman's specimen referred to in the above citation has been lost or mislaid.

BRACHYTHECIUM LABRADORICUM (Kindb.) Paris.

Eurhynchium labradoricum Kindb. Eur. & N. Am. Bry. Pt. 1: 101. 1896.

"Differs from *E. glaciale*: leaves larger somewhat glossy, not appressed when dry; cells sublinear except the large not numerous alar; costa vanishing near middle. Stem-leaves gen. entire; branch-leaves long-acuminate minutely denticulate above. Perichetial leaves patent. Capsule curved; pedicel quite smooth, 3-4 c. m. long; lid acute; peristome not seen.—Amer. r. Can. Northern Labrador: Macoun 1896."

Brotherus recognizes this species in both editions of Engler & Prantl but groups it with the salebrosa near *B. flexicaule*. The original description, quoted above, is not definite enough to enable one to get any adequate conception of the species and no authentic specimens have been available.

BRACHYTHECIUM PSEUDOVELUTINOIDES (Kindb.) Broth. E. & P., Musci, Ed. 2: 363.

Eurhynchium pseudo-velutinoides Kindb. Rev. Bryol. 22: 84. 1895.

"Leaves not or slightly striate, distant, subulate-acuminate and filiform-pointed, faintly reflexed near the base. Stem leaves subobovate or ovate-oblong, entire; costa scarcely reaching to the middle. Branch leaves ovate-lanceolate, denticulate all around; costa reaching somewhat above the middle. Perichaetial leaves with a very long filiform point. Capsules not found; pedicel rough. Tufts loose and green. Stems pinnate, not creeping. Leaves patent or spreading when dry. Probably monoecious."

"Canada, Vancouver Island, earth (1893): Macoun."

No specimens available and original description quoted.

SCLEROPODIUM Br. & Sch. Bry. Eur. 1853.

Closely allied to Brachythecium and included in it by some authors; differing slightly in the general habit and in the julaceous branches with concave, often obtuse leaves; leaf cells very long and narrow, 10-20 : 1. Stem leaves abruptly and slenderly acuminate in most species. Seta rough; capsule as in Brachythecium. All of our species are western. *S. illecebrum* and *S. caespitosum* are also European.

- | | |
|--|-----------------------|
| 1. Leaves broadly ovate to suborbicular, without pointed apex or at most short-cuspidate; auricles distinct, consisting of plainly dilated cells; aquatic..... | <i>obtusifolium</i> . |
| Leaves ovate to lanceolate; stem leaves slenderly acuminate, without distinct auricles; terrestrial..... | 2. |
| 2. Differentiated basal and alar cells few..... | 3. |
| Differentiated basal and alar cells in several rows..... | 4. |
| 3. Branch leaves ovate-lanceolate to lanceolate, acute to acuminate; capsules suberect and nearly symmetric..... | <i>colpophyllum</i> . |
| Branch leaves ovate to oblong-ovate, obtuse to abruptly short-acuminate; capsules horizontal and unsymmetric..... | <i>illecebrum</i> . |
| 4. Seta rough throughout; median leaf cells 7-12 : 1..... | 5. |
| Seta smooth below; median leaf cells 14-18 : 1..... | <i>californicum</i> . |
| 5. Branches slightly julaceous; capsules suberect and nearly symmetric..... | <i>caespitosum</i> . |
| Branches strongly julaceous; capsules more arcuate and unsymmetric..... | <i>apocladum</i> . |

This genus is perhaps too near Brachythecium. The relationship with *Eurhynchium* is much more distant. The relationship between *S. colpophyllum* and *S. caespitosum* is so close that about half the specimens of the former in American herbaria have been referred to the latter.

SCLEROPODIUM ILLECEBRUM (L. p.p.) Br. Sch. Bry. Eur. pl. 557. 1853.

Hypnum illecebrum L. p.p. Sp. Pl. 1129. 1753.

Hypnum Touretii Brid. Sp. Musc. 2: 185. 1812.

Hypnum illecebrum Schwaegr. Suppl. 1, part 2: 225. 1816.

Hypnum blandum Lyell in Hook. & Tayl. Musc. Brit., Ed. 2: 176. 1827. Suppl. pl. 5. 1827.

Plants in wide spreading mats, varying from dirty green to bright glossy green: stems 3-10 cm. long, creeping, irregularly divided, irregularly or often subpinnately branching, partially denuded of leaves in the older portions, sparingly radiculose, younger portions ascending and much like the branches; branches

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short, rarely reaching 1 cm. in length, julaceous, turgid, ascending to erect, more or less arcuate, usually obtuse; branch-leaves appressed-imbricate when dry, erect-open when moist, varying greatly in shape; those from the middle of the larger branches broadly ovate to oblong-ovate, 1.2×0.6 mm., abruptly narrowed to a short point, finely and sharply serrate above, sometimes nearly entire, very concave, slightly sulcate when dry, smooth when moist, not decurrent but half clasping, acumination of leaves often squarrose-spreading when dry; costa extending $\frac{3}{4}$ the length of the leaf, sometimes ending in a dorsal spine; median cells linear-vermicular, 0.005 mm. wide and 12-18 : 1, apical much shorter; basal subquadrate, colored and thicker-walled; alar somewhat larger and less deeply colored; leaves of the shorter branches and upper and lower leaves of the longer branches often lack the acumination and are obtuse or obtusely acute; stem leaves averaging larger, in robust plants reaching 2.3×1 mm., gradually tapering to a longer acumination, nearly or quite entire, those of the younger stems scarcely to be distinguished from the branch leaves; perichaetial leaves oblong-lanceolate, gradually narrowed above to a slender entire or subdenticulate acumination, faintly costate, acumination less slender than in *S. caespitosum*. Dioicous. Seta 1-2 cm. long; greenish brown, becoming red brown with age, twisted to the right, very rough with large papillae; capsule a little lighter colored than the seta, horizontal, unsymmetric or arcuate, with operculum 2.5 mm. long, 2.5-3 : 1; operculum long-conic, acute; annulus of two rows of cells, easily deciduous; teeth united at base, nearly colorless and papillose above; segments nearly as long as the teeth, finely papillose, from basal membrane equaling two fifths the length of the teeth; cilia 2, well developed, appendiculate; spores nearly smooth, maturing in winter.

Forma *pinnatifidum* from California in the Gray Herbarium at Harvard is more slender and nearly regularly pinnate.

Type locality, France, near Paris. Type at Paris.

On shady grassy soil and on shaded rocks.

California, Idaho, Washington, British Columbia, Vancouver.

EXSICCATI.—Sulliv. & Lesq. Musc. Bor.-Am., Ed. 2, 508; Grout, N. Am. Musc. Pl. 410, 411; Allen, Mosses Cascade Mts. 102.

ILLUSTRATIONS.—Bry. Eur. pl. 557; Husnot, Musc. Gall. pl. 95; Dixon & Jam. Handb. Brit. Mosses, pl. 53, G; Limpricht, Rab. Krypt. Fl. 4: f. 378; Pl. 11.

The robust habit, julaceous turgid branches, and thick unsymmetric horizontal capsules make this species easy to recognize when typical. It grades insensibly into *S. obtusifolium* and it is often very hard to say to which species certain forms should be referred.

SCLEPODIUM OBTUSIFOLIUM (Hook.) Kindb. Cat. Can. Pl. 6: 202. 1892.

Hypnum obtusifolium Hook. Drumm. Musc. Am. no. 193.

Hypnum arcticum var. Muell. Syn. 2: 432. 1851.

Stereodon obtusifolius Mitt. Journ. Linn. Soc. 8: 42. 1865.

Plants submerged or nearly so, attached to stones in brooks, light green above, brown below; stems irregularly branching, naked below and roughened by the leaf bases of the fallen leaves; young stems and branches julaceous; branches 5-20 mm. long; leaves closely imbricate and appressed when dry, more open when moist, broadly ovate to suborbicular, very concave, spoon-shaped, round-obtuse, without acumination or very shortly cuspidate, 1.2×1 mm., not plicate or sulcate except under pressure, entire or faintly denticulate near apex; costa stout, extending five sixths the length of the leaf; median leaf cells linear-vermicular, 0.05-0.065 mm. long, 8-10 : 1; apical cells broader and shorter, 2-3 : 1; alar cells rather abruptly enlarged to form distinct auricles, 0.013 mm. long, 3 : 1. Seta 1-1.5 cm. long, very dark and rough; capsule ovoid, nearly or quite symmetric, cernuous, with operculum 3-3.5 mm. long, 2-2.5 : 1; operculum conic-rostellate; peristome perfect, teeth dark red below, lighter and papillose above; cilia and segments about the length of the teeth; cilia appendiculate, sometimes unequal; annulus apparently lacking. Spores in winter, infrequent.

Sporophyte described from Allen's 103.

Type from rivulets in the Rocky Mts., Drummond. Type not seen, probably at Kew.

Described from Drummond's Musc. Am. 193, which is sterile. Pl. 14, f 8.

California, Nevada, Idaho, Montana, Washington, Oregon, British Columbia.

EXSICCATI.—Grout, N. Am. Musc. Pl. 109, 109a; Allen, Mosses Cascade Mts. 103; Macoun's Canadian Musci 359 is very much larger and in every way more robust than the type, but has all of the distinctive microscopic characters. The same is true of Renaud and Cardot's Musc. Sept. Exs. 111. Sullivant and Lesquereux, Musc. Bor.-Am., edition 2, no. 509 (*Hypnum illecebrum* var.), is fairly representative of the species and bears the mature sporophyte, which differs little from that of *S. illecebrum*. The capsule is a

little shorter and there are sometimes as many as four strongly nodose cilia in the endostome: the seta is exceedingly rough with very high papillae; operculum short rostrate when dry.

There can be no doubt that this should be regarded as a subspecies of *S. illecebrum*. The plants nearest the type are always submerged and nearly always sterile. A complete series can be traced from the typical form described above to typical *S. illecebrum*.

Dr. M. A. Howe has collected specimens on moist, shady banks at Berkeley, California, June 28, 1894, that have the leaf characters of the typical form, except that the leaves are longer in proportion to their width. This goes to show that the submerged growth is not entirely the cause of the inflated alar cells, shorter leaf cells and more concave leaves.

In some cases the plants are flaccid with more distant, less closely appressed leaves constituting forma *laxum*.

A form from Goldstream, Vancouver Island, Macoun, May 18, 1887, has erect branches 3-4 cm. long, strongly curved at the ends, bearing suborbicular, strongly secund leaves 2 mm. in length. For this I suggested the name var. *homomallum*. This variety is the extreme development of the robust form while the typical form is at the other extreme.

SCLEROPODIUM APOCLADUM (Mitt.) Grout, Bull. Torr. Bot. Club 26: 535. Oct., 1899.

Hypnum apocladum Mitt. Journ. Linn. Soc. 8: 35. 1865.

Plants in wide interwoven mats of medium thickness, light green above, dirty green below the surface, somewhat resembling *Eurhynchium strigosum praecox* in appearance; stems creeping, 1-4 cm. long, irregularly branching; branches often fascicled, simple or sparingly divided, 3-8 mm. in length, julaceous, attenuate; branch leaves appressed-imbricate when dry, those on the branches below the surface of the mat erect-spreading, ovate, acute to short-acuminate, scarcely decurrent, slightly serrulate at apex, otherwise nearly entire in the type, other specimens finely serrulate nearly to the base, somewhat concave, not plicate or sulcate; costa extending at least four fifths the length of the leaf, stout; median cells linear-oblong, 7-9 : 1; quadrate basal and alar cells very numerous; apical cells broader and shorter; the leaves near the apex of the branches narrower and more longly acuminate; leaves of creeping stems variable in shape, semiorbicular and abruptly short-acuminate to ovate and longer acuminate; perichaetium 4.5 mm. long, the inner leaves long-lanceolate, long and slenderly acuminate, slightly serrulate, some faintly costate. Seta about 12 mm. long, red-brown, in the type plainly papillose with low distant papillae, in other specimens strongly roughened; capsule red-brown, about 2 mm. long, 3-4 : 1, "suberect, oval cylindrical," in other specimens inclined to horizontal, unsymmetric; operculum conic-apiculate; annulus of two rows of cells; segments nearly as long as the teeth, split between the articulations; cilia two, strongly appendiculate; spores smooth, 0.013 mm. California to Vancouver Id.

A fragment of Mitten's type from "The Northwest Coast, Douglas" has been accessible, and a specimen from the United States National Museum collected at Pasadena, California, by Dr. Palmer, and determined as *S. caespitosum* has been carefully compared with this fragment. The two agree in all essential particulars. The leaves of Dr. Palmer's specimen are more acuminate and more serrulate, the seta is rougher and the capsule more unsymmetric and inclined, but these differences are no greater than frequently occur in individuals of the same species. The seta in the type is much rougher than the original description would lead one to expect.

The leaf cells are much shorter than in most species of the genus, but in all other particulars it seems closely related to the other species.

Type in Mitten Herbarium.

SCLEROPODIUM CAESPITOSUM (Wils.) Br. & Sch. Bry. Eur. pl. 556. 1853.

Hypnum caespitosum Wils. English Bot. Suppl. pl. 2878. 1849. Also Bry. Brit. 344. pl. 55. 1851.

Hypnum caespitans C. Muell. Syn. 2: 354. 1851.

Eurhynchium colpophyllum flagelliforme Barnes, Bot. Gaz. 16: 207. 1891.

Hypnum lentum Mitt. Journ. Linn. Soc. 8: 36. 1865.

Plants in rather thin loosely interwoven mats, light or dirty green; stems creeping, 5-10 cm. long, irregularly divided and branching; branches usually longer and more slender than in *S. illecebrum*, tapering, sometimes julaceous, but less frequently so than in *S. illecebrum*; branch leaves, from the middle of the branches 0.9-1 × 0.3-0.4 mm., ovate to oblong-lanceolate, usually tapering and acute at apex but sometimes nearly as obtuse as in *S. illecebrum*, appressed and imbricate to erect-open when dry, concave, scarcely plicate when moist, not decurrent, finely serrate at apex; median cells narrowly linear-vermicular, 8-12 : 1;

quadrate basal cells in several rows, alar little differentiated from the other basal cells; apical cells broader and shorter; costa stout, frequently forked, extending three fourths the length of the leaf, often ending in a spine at the back of the leaf; stem leaves ovate to ovate-lanceolate, slenderly acuminate, with a larger number of short basal and alar cells; alar cells somewhat enlarged at the decurrent angles; inner perichaetial leaves loosely sheathing at base, gradually narrowed to a long subfiliform and suberect acumen, distantly and slightly denticulate above or sometimes entire, faintly costate. Dioicous. Seta 10–15 mm. long, red-brown, twisted to the right, very rough; capsule light brownish-green, oblong-cylindric, suberect, slightly unsymmetric, with operculum 2–2.5 mm. long, about 2.5 : 1; operculum conic-apiculate to conic-rostellate, often appearing short-rostrate when dry; annulus of two rows of cells, deciduous; teeth of peristome slender, subhyaline and slightly papillose at apex; segments nearly as long as the teeth, yellowish, more strongly papillose, from a wide basal membrane and widely open between the articulations; cilia two, very strongly nodose; spores rough, about .016 mm., maturing in winter.

Type locality, Langford, near Warrenton, England.

Growing on stumps and old logs, roots of trees and rocks. California, Washington, Oregon, Vancouver Island, Lake Athabasca (Macoun), Alaska (Kellogg).

ILLUSTRATIONS.—See above; also Dixon and Jameson, *pl. 153, B*; Husnot, *Musc. Gall. pl. 115; Pl. 11*. EXSICCATI.—As *Hypnum caespitosum*; Sull. & Lesq. *Musc. Bor.-Am.* 510; Macoun, *Can. Musc.* 290 (in part only. See under *S. colpophyllum*); Grout, *N. Am. Musc. Pl.* 168, 168a, 424; *Musci Perfecti* 39.

Sterile and robust *S. caespitosum* is hard to distinguish from *S. illecebrum*. In general it is more slender, less frequently julaceous with closely imbricated leaves, with tapering branches and narrower more gradually tapering leaves having their median leaf cells longer and rather narrower and the differentiated basal cells more numerous. It also comes very close to slender forms of *S. colpophyllum*.

Sullivant and Lesquereux's exsiccati (*l. c.*) do not agree very closely with Wilson's *Musc. Brit.* 349, or with the plate in the *Bryologia Europaea*. The stem leaves are too abruptly acuminate with too short an acumen. This is a variation in the direction of *S. obtusifolium*, but as these characters are variable according to Wilson's own description, these specimens should probably be referred to a form of *S. caespitosum*. Dr. M. A. Howe has collected a moss on "Redwood stumps, Mill Valley, Marin Co., California, January 16, 1892," that agrees very closely with Wilson's exsiccati, so that there can be no reasonable doubt of the identity of the European and American plant. *

Var. *SUBLAEVE* R. & C. *Bot. Gaz.* 15: 61. 1890.

"Pedicel nearly smooth, slightly rough only below the capsule. Oregon, Suavies Island (Th. Howell)." M. Cardot very kindly sent me a portion of this for examination. It agrees with the typical form except as noted above.

SCLEROPODIUM COLPOPHYLLUM (Sulliv.) Grout, *Bull. Torr. Bot. Club* 26: 538. Oct., 1899.

Eurhynchium colpophyllum Sulliv. *Icon. Musc. Suppl.* 95. *pl. 71.* 1874.

Brachythecium colpophyllum Kindb. *Can. Rec. Sci.* 1894: 73. 1894.

Eurhynchium Macounii Kindb. *Rev. Bryol.* 22: 85. 1895.

Gametophyte in wide, soft intricate mats, dirty green; stems creeping, radiculose, about 5 cm. long, often stoloniferous, much elongated; branches numerous, erect, about 5 mm. long, terete-foliate, often julaceous; branch leaves closely imbricate when dry, erect-spreading when moist, not decurrent, oblong-lanceolate to broadly ovate-lanceolate, 1.3–1.5 × 0.45–0.6 mm., acute or broadly acuminate, serrate above, very concave, scarcely plicate; costa extending four-fifths length of leaf, ending in a spine on the under side; median leaf cells long-linear, 14–18 : 1; basal somewhat shorter and broader; a few of the alar cells quadrate; stem leaves triangular-ovate, long and slenderly acuminate, 1.3–1.8 × 0.8 mm.; perichaetial leaves with sheathing bases and loosely erect-open points, oblong-ovate, slenderly acuminate, costate, nearly entire. Dioicous. Seta about 15 mm. long, light brown, flexuous, twisted to the right, rough with rather distant conical papillae; capsule brown, oblong-cylindric, suberect, more or less arcuate, with the operculum about 2 mm. long, 2.5–3 : 1; slightly constricted under the mouth when dry; operculum conic-rostrate; annulus present, of two rows of cells, easily detachable; segments nearly as long as the teeth, widely split; cilia 2, strongly nodose or subappendiculate; spores minutely roughened, 0.012–0.016 mm., maturing in autumn.

Type locality, California, Bigelow. Type in the Gray Herbarium; examined by the author.

Not rare in California, but frequently confused with *S. caespitosum*; Vancouver Island, Macoun; Alaska, Kellogg.

ILLUSTRATIONS.—Sulliv., *l. c.* Evidently Sullivant did not figure any stem leaves, as those on the type specimen are quite different from any in the figure in the *Icones*. *Pl. 12.*

EXSICCATI.—Grout, *N. Am. Musc. Pl.* 193, 392, 469; *Musci Perfecti*, 18.

This species is much nearer slender-leaved forms of *S. caespitosum* than is generally recognized. It is distinguished from *S. caespitosum* by its narrower more slenderly acuminate branch leaves, which are more sharply serrate, with median cells longer and narrower, enlarged basal and alar cells much less numerous. In gross appearance the whole plant, and particularly the branches, is much longer. It is undoubtedly a derivative of *S. caespitosum* and intermediate forms are not very rare.

Type specimens of var. *flagelliforme* Barnes have the shorter median cells and the more numerous differentiated basal cells of *S. caespitosum* and seem to me to belong to that species. The slender flagelliform branches are not rare in *S. caespitosum*.

Var. *ATTENUATUM* Grout, *l. c.*

Stoloniferous, much more slender with more distant loosely spreading leaves; leaves much narrower with a longer and more slender acumination; branch leaves varying from 1.7×0.54 mm. on the longer branches to 1×0.2 on the smaller.

Type from perpendicular rocks, Victoria, Vancouver Id., May 2, 1893, Macoun.

Type in the herbarium of the Geological and Natural History Survey of Canada at Ottawa.

SCLEROPODIUM CALIFORNICUM (Lesq.) R. & C. *Rev. Bryol.* 20: 19. 1893.

Hypnum californicum Lesq. *Trans. Am. Phil. Soc.* 13: 13. 1863.

Stems and branches very slender, subulaceous; branch leaves ovate-lanceolate, concave below, slenderly acute to acuminate, more or less serrulate above; median cells linear-vermicular, about 12 : 1; quadrate basal cells very numerous, extending entirely across the base in several rows, rather larger and rounder next the costa; stem leaves somewhat broader and acuminate, nearly entire; costa stout at base, extending $\frac{2}{3}$ – $\frac{3}{4}$ the length of the leaf. Seta about 1.5 cm. long, rough above, nearly or quite smooth below; capsule oblong-cylindric, cernuous. Type seen, from California, Bolander. Apparently rare.

No locations outside of California noted. The seta does not seem to be as smooth below as is indicated in the original description. Specimens from Santa Catalina Island (Bartram, 1017a) are mixed with *Camptothecium arenarium* and are difficult to distinguish without careful microscopic examination. The leaves of the *Camptothecium* are plicate while those of the *Scleropodium* are not noticeably so.

EXSICCATI.—Sull. & Lesq. *Musc. Bor. Am. Ed.* 2. 511.

CAMPTOTHECIUM Br. & Sch. *Bry. Eur. fasc.* 52–54. 1853

Plants of medium to large size, erect or ascending, densely foliate; stems with central strand; branching often regularly pinnate, green to glossy yellow-green; most leaves broadly to narrowly lanceolate and long and slenderly acuminate (excl. *C. megaptilum*), deeply plicate, costate to above the middle; median cells very long and narrow, 10–20 : 1; alar cells differentiated, usually quadrate and thick-walled; inner perichaetial leaves usually long-filiform acuminate. Dioicous in most cases. Seta rough in all our species except *nitens* and *paulianum*. Capsules oblong-cylindric, more or less curved, especially when dry; peristome perfect; operculum conic to conic-rostrate. Type species *C. lutescens*.

This genus is distinguished from *Brachythecium* by the longer capsule and longer leaf cells, from *Scleropodium* by the more plicate and more slenderly acuminate leaves and from *Homalothecium* by the more curved capsule and well developed cilia.

KEY.

- | | |
|---|-----------------------|
| 1. Stems densely radiculose throughout..... | <i>nitens</i> . |
| Stems almost without radicles except where in contact with substratum..... | 2. |
| 2. Plants plainly and regularly pinnate..... | 3. |
| Plants not regularly pinnate..... | 6. |
| 3. Plants large, coarse, upright, reaching a height of 12 cm., branch leaves blunt..... | <i>megaptilum</i> . |
| Plants much smaller, delicate, creeping..... | 4. |
| 4. Stem leaves slenderly acuminate, costa rarely ending with more than one spine..... | 5. |
| Stem leaves acute to blunt, costa with several spines at back near the end..... | <i>alsioides</i> |
| 5. Branch leaves slenderly acuminate, costa without spines; capsule about 3 : 1..... | <i>pinnatifidum</i> . |
| Branch leaves merely acute, costa often ending in a spine; capsules 5–6 : 1 when dry.. | <i>Amesiae</i> . |
| 6. Plants little branched, leaves strongly secund, giving the appearance of a Drepano- | |
| cladus; seta smooth..... | <i>paulianum</i> . |
| Plants branching freely, leaves rarely secund; seta rough..... | 7. |

7. Plants robust, with the habit of a large Brachythecium; alar cells thick-walled and dense; seta rough throughout. 8.
 Plants slender; quadrate alar cells numerous, extending across base of leaf; seta nearly smooth above. *arenarium*.
 8. Branch-leaves slenderly acuminate. *lutescens*.
 Branch-leaves with "points broad". *aeneum*.

CAMPTOTHECIUM LUTESCENS (Huds.) Br. & Sch. Bry. Eur., fasc. 52-54, pl. 558. 1853.

Hypnum lutescens Huds., Fl. Angl. 421. 1762.

Hypnum fulgescens Mitt., Bot. Zeit. 1853: 170. (Douglas's specimen seen in the Mitten Herbarium.)

Hypnum pseudosericeum Muell., Regensb. Flora, 8: 89. 1875.

Plants in loose spreading mats or tufts with the habit of one of the larger Brachythecia, green to light yellow-green, glossy, brownish below, rather stiff when dry; stems ascending, irregularly to subpinnately branching, cortical cells elongated-linear; leaves crowded, erect-open when moist, erect to appressed when dry; stem leaves slightly decurrent, elongated triangular-lanceolate, gradually narrowed from the base to a long-filiform apex, 2-3 mm. long, entire or nearly so, deeply 4-plicate, margins recurved below; costa extending $\frac{3}{4}$ the length of the leaf or more, occasionally ending in a spine on the back; basal and alar cells dense and thick-walled, often colored; the alar minute, rounded-quadrate; median narrowly linear, 10-15 : 1, basal shorter; branch leaves smaller, less plicate, the upper less slenderly acuminate and serrulate, frequently with very minute teeth on the basal margin, occasionally some have shorter and broader apical cells; perichaetial leaves numerous, the inner reaching 4 mm. in length, oblong below and more or less abruptly narrowed to a long-filiform acumination, as a rule coarsely dentate at the base of the acumination, thinly costate. Dioicous or pseudo-monoicous. Seta 2-2½ cm. long, rough with numerous very large papillae; urn 2-2½ mm., oblong-cylindric, sometimes almost erect and symmetric but usually somewhat curved, contracted under the mouth when dry and empty; operculum conic-rostrate, reaching 1 mm.; annulus of two rows of cells; peristome of the perfect hypnaceous type with segments about as long as the teeth, split along the keel, and with two long slender cilia; spores in late autumn and winter. Type locality English?

Most of the American plants are the:

Var. OCCIDENTALE R. & C. Robust, usually bright glossy yellow-green above; branch leaves usually less slenderly acuminate and more serrate; capsules 3-4 mm. long.

On trees, stumps, and logs; in Europe on calcareous rocks and dunes. Frequent west of the Rockies in the northern U. S. and Canada.

ILLUSTRATIONS.—Bry. Eur., l. c.; Pl. 12.

EXSICCATI.—Var. *occidentale*. Allen, Mosses of the Cascade Mts. 99; Grout, N. Am. Musc. Pl., 68, 68a.

CAMPOTHECIUM AENEUM (Mitt.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77.

Hypnum aeneum Mitt. Journ. Linn. Soc. 8: 31. pl. 5. 1865.

Smaller than the last; cortical cells of branches somewhat quadrate-rectangular; leaves smaller and less plicate, acute to slenderly acuminate; stem leaves slightly decurrent; branch leaves shortly acuminate to acute, more strongly serrate; basal and alar cells less dense, upper cells of branch leaves shorter and broader, oblong; perichaetial leaves usually ecostate, otherwise as in the last. Seta less strongly roughened, especially above; capsule about as in *C. lutescens* except that the operculum is conic-apiculate, not rostrate in specimens seen in perfect condition; the capsule seldom, if ever, straight and erect; peristome perfect, often with three cilia as long as the segments; spores in winter. Type from the Pend d'Oreille R., B. C., Lyall.

ILLUSTRATIONS.—Mitten l. c.; Pl. 14.

EXSICCATI.—Allen, Mosses of the Cascade Mts. 97; Grout, N. Am. Musc. Pl. 204.

On rocks with the range of the last but less common. Black Hills, S. D., Montana, Idaho, Wyoming.

The apices of the branch leaves and the shorter operculum distinguish this from the last. It also seems to average smaller and the leaves are usually more appressed. The larger size, the leaf apices, and the more irregular branching distinguish it from *C. pinnatifidum*.

This evidently is a xerophytic derivative of *C. lutescens* and it is to be regretted that the species was not founded on the extreme variant which Cardot described as *C. dolosum* R. & C., Hedwigia 32: 336. 1893, which is best classified as:

Var. DOLOSUM (R. & C.) Grout, Bryologist 31: 43. 1928. Robust, branch-leaves broadly acute, especially the upper; costa broader and ending abruptly in the apex; leaf cells of apex even broader and shorter. See notes under *C. Amesiae*.

Var. ROBUSTUM Grout, l. c.

Very large and thick-stemmed, regularly pinnate, subcircinate when dry. On rocks, Shasta Springs, Calif. (M. A. Howe). N. Am. Musc. Pl. 30 is the type collection. Type, in herb. A. J. G. (30 was issued as *Camptothecium nevadense*).

CAMPTOTHECIUM PINNATIFIDUM (Sull. & Lesq.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 315.

Hypnum pinnatifidum Sull. & Lesq., Mem. Calif. Acad. 1: 33. 1868.

Plants in wide loose mats, usually a bright glossy green, often paler; stems slender, prostrate, brittle, closely and regularly pinnate; branches short, incurved when dry, sometimes attenuate, cortical cells quadrate-rectangular; leaves erect-open when moist, more or less appressed when dry; stem-leaves ovate-lanceolate to lanceolate, slightly decurrent, reaching 2 mm. in length, gradually and slenderly acuminate, usually slightly toothed at apex, somewhat plicate with borders recurved below; a comparatively large area of alar cells quadrate and larger and clearer than in any of the preceding; median cells reaching $75\ \mu$, about 15 : 1; costa rather stout, extending about $\frac{3}{5}$ length of leaf; branch leaves smaller, less slenderly acuminate, more serrate at apex; inner perichaetial leaves elongated-lanceolate, reaching 3.5 mm., very long and slenderly acuminate, nearly or quite entire and ecostate. Seta 1.2-1.8 cm. long, rough throughout; capsule oblong or obovate, with operculum reaching 2 mm., cernuous and curved; operculum short-conic; annulus large; peristome perfect; segments as long as the teeth, open between the articulations; cilia 2, well developed; spores in winter. Type locality, in canyons, California (Bolander).

On soil and rocks, California to British Columbia, frequent.

ILLUSTRATIONS.—Sull. Icones, Suppl. 101. pl. 77; Pl. 13.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am., Ed. 2, 513; Grout, N. Am. Musc. Pl. 28; Allen, Mosses Cascade Mts., 98.

Cardot states (Hedwigia 32: 336) that *C. pinnatifidum* is merely a variety of the European *C. aureum* (Lag.) Br. & Sch., differing in its more slender and creeping stems and shorter capsules. He also states that similar forms are found in Southern Europe and that Roell's nos. 105a & 107 from Vancouver are completely identical with the European *C. aureum*.

CAMPTOTHECIUM AMESIAE R. & C., Bot. Gaz. 13: 202. 1888.

Regarded by the authors (Hedwigia, l. c.) as a subspecies of the last, from which it differs in its broader and shorter pointed, more strongly serrate branch-leaves; costa thicker and spinose at the upper end, and the capsule usually longer. The branch leaves are ovate-lanceolate and slenderly acute rather than acuminate and the costa extends to within a few cells of the apex. Type, from Auburn, California (Mrs. Mary E. P. Ames).

On soil, rocks and bases of trees, California to Vancouver Island.

ILLUSTRATIONS.—R. & C., l. c.; Pl. 12.

EXSICCATI.—Baker, Pacific Coast Bryophytes, 374. [Although this was identified by Cardot himself ("*Forma foliis longius acuminatis*") it is an intermediate form that seems to me to be nearer *C. pinnatifidum*.] Grout, N. Am. Musc. Pl., 416. This is also an intermediate form with branch-leaves more slender pointed than in the typical form.

Sterile, this is likely to be confused with *C. aeneum*, especially its var. *dolosum*, but it is typically smaller, more slender and much more regularly pinnate, and has a much larger area of clearer quadrate alar cells.

In fruit the slenderly acuminate entire perichaetial leaves and the more slender capsules will identify it. Sterile, it is also likely to be confused with *Homalothecium nevadense subulatum*, but in that plant all the leaves are very narrowly lanceolate.

CAMPTOTHECIUM ARENARIUM (Lesq.) Jaeger & Sauerb., St. Gall. Nat. Gesell. 1876-77: 315.

Hypnum arenarium Lesq., Trans. Am. Phil. Soc. 13: 13.

In wide loose mats, dirty yellow-green; stems slender, much as in *C. aeneum*, irregularly branching; branches short and erect, or longer and attenuate; cortical cells quadrate-rectangular, at least in part; leaves erect, imbricate; costa stout, extending into apex; stem leaves ovate-lanceolate, slightly decurrent, slenderly acute to acuminate, entire or slightly serrulate above, reaching 1.5 mm. in length, strongly concave at base like the base of a spoon; margins recurved below; median leaf cells narrowly linear, reaching $75\ \mu$ in length, 15-20 : 1; quadrate alar cells numerous and a band of similar cells extends entirely across the base of the leaf; upper cells sometimes papillose on back at angles; branch-leaves shorter and smaller, acute, sometimes slenderly so, and strongly serrate at apex; costa often extending almost to apex and ending in a spine or spines on the back; some of the inner perichaetial leaves abruptly narrowed into a filiform serrulate point, coarsely dentate below it. Seta 15 mm. long, rough toward the base, smoother above; capsule

ovoid-cylindric, urn about 2 mm. long, cernuous, curved; operculum conic-apiculate; annulus large, persistent; peristome perfect; segments as long as the teeth (?), split along the keel; cilia one or two, short. *Pl. 14.*

Type locality, near San Francisco, California.

EXSICCATI.—Sull. & Lesq., *Musc. Bor. Am.*, Ed. 2, 512.

S. California, several locations, Santa Catalina Island (Bartram and Kingman); Washington (Frye). On shaded banks, often growing in sand.

CAMPTOTHECIUM ALSIODES Kindb. *Pittonia* 2: 243. 1892.

Plants dark to bright green with much the habit of *C. pinnatifidum* except that they are less regularly pinnate; stem leaves broadly ovate-lanceolate, reaching nearly 1 mm. in length, acute to short acuminate, concave below with margins recurved, slightly decurrent, serrulate above; costa stout, almost percurrent, in all but the lower stem leaves ending in stout spines; median leaf cells linear, reaching 50 μ in length; quadrate basal and alar cells much as in *C. arenarium*, numerous, small and dense; branch-leaves smaller, lanceolate, almost obtuse, strongly serrate above; upper leaf cells papillose at the angles; *costa very broad and stout at the end and bearing several large spines*; "perichaetial leaves abruptly narrowed to a long subuliform denticulate acumen." Seta about 16 mm. long, rough; capsule subcylindric, curved; lid conic-apiculate; peristome perfect with cilia; segments split along the keel. Type from rocks, Mill Valley, Marin Co., California (M. A. Howe). Type duplicate seen but no sporophyte. *Pl. 14.*

Although this seems to be the only locality from which it has been collected the italicized characters are so distinct and so well marked that no difficulty will be experienced in recognizing it when typical, but, at best, it is only a subspecies of *C. arenarium* with which it apparently intergrades. It is more regularly pinnate and the costa in the branch leaves is more nearly percurrent and more strongly spinose, also the leaf cells are more papillose.

CAMPTOTHECIUM NITENS (Schreb.) Schimp. *Syn.* (Ed. 1) 530. 1860.

Hypnum nitens Schreb., *Spic.* 92. 1771.

Tomenthypnum nitens Loeske, *Deutsch. Bot. Monatsschr.* 20: 82. 1911.

Plants bright shining green to golden brown; usually growing in deep masses, frequently among other plants; stems erect, 6-15 cm. tall, covered up to the latest season's growth with brown, much branched, intertangled radicles; subpinnately to irregularly branched; stem-leaves elongated-lanceolate, from a narrow base, crowded, erect, long and slenderly acuminate, 3-4 mm. long, deeply plicate; margin very narrowly recurved, entire or nearly so; costa extending $\frac{3}{4}$ the length of the leaf, often radiculose at back; leaf cells narrowly linear-vermicular, 50-75 μ , 10-15 : 1, a few at the base and angles short and thick-walled; branch-leaves smaller; inner perichaetial leaves gradually long and slenderly acuminate reaching 5 mm. long. Seta smooth, 2-5 cm. long; capsule oblong-cylindric, cernuous, curved; urn 2-3 mm. long, contracted under the mouth when dry and empty; operculum conic; peristome perfect with long cilia; spores in spring. Type, European.

ILLUSTRATIONS.—Bry. Eur. *pl.* 622; M. H. M. 296.

EXSICCATI.—Drumm., *Musc. Am.* 172; Sull. & Lesq., *Musc. Bor. Am.* 327, 486; Aust., *Musc. Appal.* 397, 308 var.; R. & C., *Musc. Am. Sept. Exs.* 321; Macoun, *Can. Musc.* 278 & 279; Grout, *N. Am. Musc. Pl.* 203.

In bogs and swamps in cool or elevated regions across the continent, south to New Jersey. Frequent but rarely fruiting.

CAMPTOTHECIUM MEGAPTILUM Sull., *Icon. Musc. Suppl.* 102. *pl.* 78. 1874.

"Plants highly caespitose," light green and glossy above, brown below, very large, reaching 15 cm. without radicles except at base, with habit of *Hylocomium*; branches distichous, reaching 1.8 cm. in length; leaves crowded, erect-imbricate; stem leaves triangular-ovate, acute to acuminate, strongly plicate with many folds, subdecurrent; two or three rows of basal cells short with walls much thickened and porose and perhaps another row or two of similar cells at the basal angles; median cells very long and narrow, linear-vermicular; branch-leaves ovate-lanceolate, with apex acute to rounded, concave and plicate with recurved margins below, sharply serrate above, serrulate below; costa extending well above the middle and toothed above on the back, as are some of the folds. Pseudo-monoicous. Seta very rough; capsules oblong, curved and cernuous; operculum conic-apiculate; peristome perfect with two long, appendiculate cilia; spores in winter. Type from Oregon, (Hall). *Pl. 13.*

On soil and over rocks in coniferous forests. Pacific coast, California northwards.

EXSICCATI.—Allen, Mosses of the Cascade Mts., 101; Grout, N. Am. Musc. Pl., 23 and 23a.

Sullivan's plate, gives a misleading idea of the usual leaf form. In branch-leaves the apex is acute or rounded. The stem-leaves are very much broader than those of the branches.

Var. *FOSTERI* Grout, l. c. 46. Branch leaves narrowly acuminate; stem leaves long-filiform acuminate, as in *Brachythecium albicans*, entire or with one or two sharp teeth above. Silverton, Oregon (A. S. Foster). Pl. 14.

CAMPTOTHECIUM PAULIANUM Grout, Pub. Puget Sd. Biol. Sta. 388: 53. 1921.

Robust, bright yellowish-green. Apparently growing in a deep mass with erect stems. Stems 6–10 cm. long, irregularly and sparingly branching, not radiculose, colored when old; leaves strongly secund, giving the plant the appearance of a *Drepanocladus*; stem leaves lanceolate to ovate-lanceolate, reaching 4 mm. or more in length, not decurrent, costate to the base of the very long filiform acumen, nearly or quite entire, very strongly sulcate and plicate; leaf cells very long and narrow, 50–70 μ long, the walls nearly half as thick as the width of the lumen; alar cells broader and shorter, oblong to subquadrate; branch leaves similar, but often serrulate; perichaetial leaves lanceolate, reaching 6 mm. in length, long-filiform acuminate, serrulate above. Seta reaching 4 cm. in length, smooth; capsule oblong-cylindric, somewhat curved and cernuous, about 3 mm. long; operculum conic-apiculate; peristome immature but apparently perfect. Associated with *Tortula ruralis*. Pl. 14.

St. Paul Island (Kincaid, 1899). Type in herbarium of A. J. Grout.

HOMALOTHECIUM Br. & Sch., Bry. Eur. fasc. 46–47. 1851.

Very closely allied to *Camptothecium*, differing in little but the nearly or quite erect and symmetric capsule and imperfect peristome, in which the cilia are rudimentary or wanting and the segments are often reduced. Brotherus states in the second edition of Engler and Prantl that the inner peristome is attached to the outer in *Homalothecium* and makes this the distinction from *Pleuropus*. The attachment is so slight that it is scarcely mentioned, except by Limpricht, in the descriptions of European species and I have not detected it *H. nevadense*, hence I have included *Pleuropus Bonplandii* (Hook.) Broth., a recent addition to our flora from Texas. Type species *H. sericeum* (L.) Br. & Sch.

KEY.

- | | |
|---|--------------------|
| 1. Leaves dentate at base and often at apex with sharp, often recurved teeth..... | <i>Nuttallii</i> . |
| Leaves not dentate at base, very slender..... | 2. |
| 2. Regularly pinnate, northwestern..... | <i>nevadense</i> . |
| Not pinnate, southern, principally tropical..... | <i>Bonplandii</i> |

HOMALOTHECIUM NEVADENSE (Lesq.) R. & C. Hedwigia, 32: 334. 1893.

Hypnum nevadense Lesq., Mem. Calif. Acad. 1: 33. 1868.

Plants in wide thin intricate mats with the habit of *H. Nuttallii*, pinnately branching; lower stem leaves elongated-lanceolate, reaching 2 mm. in length, somewhat decurrent, gradually very long-filiform acuminate, concave at base, plicate with lower margins recurved; median cells very long and narrow, about 60 μ long; a few basal cells shorter and broader and a small group of alar and decurrent cells quadrate, small; upper stem leaves broader and less slenderly acuminate, subserrulate; branch leaves smaller, less slenderly acuminate and serrulate at apex, occasionally with a few teeth on the margin of the area of quadrate alar cells; costa stout for the genus, diffusing into the apex and in the upper branch leaves almost filling it; perichaetial leaves oblong-lanceolate, the inner sometimes gradually long filiform acuminate, sometimes abruptly acuminate and coarsely dentate at base of acumination. Seta about 1.5 cm. long, rough, sometimes only slightly so above; capsule, oblong-cylindric when dry and empty, urn reaching 3 mm., nearly erect and symmetric; operculum rostrate; annulus present; segments of peristome slender, nearly or quite as long as the teeth, open between the articulations; cilia very rudimentary or wanting; spores in winter. Type from Yosemite, California. This species resembles *Camptothecium Amesiae* in general appearance and in the serrate branch leaves but is readily distinguished by the fact that all the leaves are very narrowly lanceolate. Its very narrow stem leaves and very slight or lacking serration of the basal margins distinguish it from *H. sericeum* and *H. Nuttallii*. From the var. *leucodontoides* of this latter it is more difficult to distinguish; see under the description of that form. Known from California to Washington, Idaho, Montana, and British Columbia. Pl. 14.

I have seen plants labelled in Lesquereux's handwriting but they scarcely correspond to this part of the original description, "Distinguished from *Hypnum lutescens* Huds. . . . by its larger thick stems and branches; . . . They are more regularly and deeply plicate than in any other *Camptothecium*." All the plants I have seen are distinctly more slender than in *Camptothecium lutescens* and the leaves are certainly not more plicate than in that species. He also indicates the differentiated alar cells as fewer than I find them. Cardot also claims to have seen specimens from the herbarium of Lesquereux that gave him substantially the same idea of the species as I have obtained. In perfect condition the oblong-ovoid capsule, distinctly larger at base, the rostrate operculum and lack of cilia in the peristome together with the narrow leaves, usually entire at base and strongly costate even into the apex of some of the branch leaves, enables one to recognize it with reasonable certainty. When dry and empty the capsules become cylindric. The plants are rather more robust than *Camptothecium pinnatifidum* and much less regularly pinnate.

Var. *SUBULATUM* R. & C. *Hedwigia* 32: 334. 1893.

Homalothecium sericeoides C. Muell. & Kindb. Cat. Can. Pl. 6: 175. 1892.

(Fide Barnes and Heald, Keys to N. Am. Mosses 335.)

This is a form with leaves longer acuminate, subulate and much less plicate. Some forms of the variety, notably a form New Denver, B. C., collected by Mrs. MacFadden and issued as No. 5 of the Supplement to my N. Am. Musci Pleurocarpi, have one or two rudimentary cilia.

EXSICCATI.—(Species) Allen, Mosses Cascade Mts. 100; Roell, Nordamerikanische Laubmoose, 696-699, 840 and 924, fide Cardot. (var.) Roell, 702-704 and 841, fide Cardot; Grout, l. c.

HOMALOTHECIUM NUTTALLII (Wils.) Grout, n. comb.

Hypnum Nuttallii Wils. Bryol. Brit. 334. 1855.

Camptothecium Nuttallii Bry. Eur. *Camptothecium*, 6. 1853.

Plants in wide rather thin intertangled mats, bright yellowish glossy green in the younger portions, turning progressively brown with age, densely and regularly pinnate with short, somewhat curved branches, having quadrate to short rectangular cortical cells; leaves erect, crowded, appressed when dry; stem leaves reaching 2 mm., somewhat concave and subclasping at base with margins recurved, elongated-triangular, gradually and slenderly acuminate, little striate, branch leaves more concave below with recurved margins, long-lanceolate, coarsely dentate at base, serrate above; sometimes with sharp recurved teeth at the apex of some of the upper leaves; costa stout, vanishing in the apex; median cells narrowly linear vermicular, about 75 μ long, 20 : 1; alar quadrate, clear as in *Camptothecium pinnatifidum*; inner perichaetial leaves elongated-oblong, long-filiform acuminate, entire, occasionally toothed at base of acumen. Seta short, about 1 cm., very rough; capsules long-cylindric, suberect and somewhat curved, with a short distinct neck, reaching 3 mm.; operculum conic-rostrate; annulus narrow; segments of peristome slender, from a wide basal membrane, as long as the teeth, split along the keel; cilia short and rudimentary; spores in early winter. Type Menzies No. 53.

On trunks of trees, logs and less frequently on rocks. West coast from California to British Columbia, Idaho, Montana.

ILLUSTRATIONS.—Sull. *Icones* pl. 128; Pl. 13.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. 338b and 514; R. & C. Musc. Am. Sept. Exsicc. 100; Grout, N. Am. Musc. Pl. (as *Camptothecium*) 24, 79, 238 and 351; var. *haemitidens* Kindb., 80; var. *tenue* Kinb. 381; Grout, Musci Perfecti 36.

Var. *HAEMITIDENS* Kindb. (*Hypnum haemitidens*) Bull. Torr. Bot. Club 16: 97. April, 1889 is a form of *Nuttallii* more slender with the leaves hooked denticulate at apex. Dr. Bailey states that he has found the ordinary form on top of a log while at the sides where the water drips from the pendent stems and branches the var. *haemitidens* develops. I believe that many of the exceedingly variable forms from the Pacific Coast are due to the excessive dampness and heavy rainfall. Another example of a similar variation due to a similar cause is the variable and stoloniferous *Pseudisotheceum stoloniferum* (Hook.) which has hardly two leaves alike on the same plant and is yet so near the European *P. myosuroides* that by many authors it is not considered distinct. In a series I have examined some specimens would have the recurved teeth on very few leaves while some would scarcely be serrate; on other plants the majority of the leaves were thus serrate.

Var. *TENUIS* Kindb. is the extreme of the *haemitidens* variation and is well illustrated in Macoun's 473 and my 80. Cardot states [as quoted on the label of Baker's Pacific Coast Bryophytes no. 573 "*Camptothecium Nuttallii* form *leucodontoides* (Kindb.)"] that *C. leucodontoides* Kinb. Rev. Bryol. 1895 is only a simple form of *H. Nuttallii*. This form has the dentate leaves of *Nuttallii*. I agree with his conclusions but I think my specimen of 573 is *C. Amesiae*.

Homalothecium sericeum (L.) Br. & Sch., a common European species, is reported from the N. W. Coast and is so credited to N. America in the second edition of Engler & Prantl but I doubt its occurrence there. I have not yet seen a specimen from this region. The close relationship between this species and *H. Nuttallii* has seemingly not been noted. The leaves of *H. sericeum* are almost as sharply dentate on the basal

angles as in *Nuttallii* but the teeth seem to be principally on the margin of the area of quadrate alar cells. *H. sericeum* is, however, readily distinguished by its much more concave and strongly plicate leaves and very short segments of the peristome. Probably the report of *sericeum* from N. America is based upon an erroneous determination of a form of *H. Nuttallii*.

H. corticola Kindb. Macoun, Can. Cat. 6: 274. 1892 is to my mind a form of *H. nevadense*. A specimen from Vancouver collected by Macoun and communicated to N. Y. Bot. Gardens is so evidently depauperate and undeveloped as to make it unworthy of serious attention. It has the quadrate-rectangular cortical cells which are so characteristic of *H. Nuttallii* but it has not the dentate basal leaf-margin. This same type of cortical cells is also found in *Camptothecium pinnatifidum* and in *C. Amesiae* and the leaves of this specimen are very like short leaves of *Amesiae*. It does not fit the description at all and is evidently an error.

HOMALOTHECIUM BONPLANDII (Hook.) Jaeger & Sauerb., St. Gall. Nat. Gesell. 1876-77: 379.

Pleuropus Bonplandii (Hook.) Broth. Engler & Prantl, Ed. 1: 1138.

Leskea Bonplandii Hook. Kunth. Syn. Pl. Aequin 1: 61.

Plants dark green, reddish or brownish, about the size of *Camptothecium lutescens* but with leaves rather more spreading; branching irregular to fasciculate; branch leaves erect-open very slenderly triangular-lanceolate, sometimes slightly secund, about 3 mm. long by 1.2 mm. wide, somewhat cordate and concave; apex very slender, subfiliform; at base rather lightly plicate when moist, strongly so when dry; serrulate all around; leaf cells narrowly linear-vermicular; a small area of alar cells oval to quadrate; costa rather slender, extending well into the apex. Seta about 1.5 cm. long, capsule narrowly ovoid-cylindric, erect and symmetric; operculum long-rostrate; cilia of the inner peristome rudimentary. Pl. 14.

Head of Guadalupe River, Texas, alt. 2000 ft. Mrs. E. A. Harris. Com. Bartram. Collected April 1928, new to the U. S.; frequent farther south.

The distinction given by Brotherus to separate *Pleuropus* from *Homalothecium* is that in the latter the inner peristome is adherent to the outer. There is no evidence of this in the American species and few European authors mention it in describing the European forms.

HOMALOTHECIELLA Cardot, Bryologist 7: 31. 1904.

Homalotheciella differs from *Homalothecium* in its small size and concave nonplicate leaves. From *Brachythecium* it differs in the hairy calyptra and imperfect peristome. The plants have almost the appearance of a *Pylaisia*. The resemblance is all the more striking because the segments of the endostome adhere to the teeth as in *Pylaisia intricata*, (Hedw.) R. & C. One cannot help wondering if the similarity between *Pylaisia*, *Platygyrium* and this species is not due to the fact of their having a similar habitat. May it not be that their approach in capsule to *Leskea*, *Leucodon*, *Anomodon*, etc., is due to the same cause?

HOMALOTHECIELLA SUBCAPILLATA (Hedw.) Card.

Burnettia subcapillata (Hedw.) Grout. Bryologist 6: 65. 1903.

Pterogonium subcapillatum Schwaegr. Suppl. 1: 107, 1811.

Pterigynandrum brachycladon Beauv. & Brid., in Brid. Musc. Recent. Part 4: 130. 1819.

Pterogonium decumbens Schwaegr. Suppl. 2: 32, pl. 110. 1823.

Lasia subcapillata Brid. Bryol. Univ. 2: 202. 1827.

Homalothecium subcapillatum Sulliv. Gray's Man. Ed. 2: 663. pl. 5, 1856, and Icones Musc. 41, pl. 90. 1864. See Plate 111.

Platygyrium brachycladon Kindb. Can. Rec. Sci. 21: 1894.

Monoicous, in light-green, thin glossy mats; stems a few centimeters long, irregularly dividing, creeping, subpinnately branching; branches about 5 mm. in length; branch leaves often somewhat homomalous, loosely imbricate, ovate to elliptical-oblong, .9-1.2 × .3-3.5 mm.; abruptly long acuminate, more or less serrate above, smooth, concave; costa extending to middle or beyond; median cells linear-fusiform, 8-9 times as long as broad, quadrate alar cells about 10 μ wide, numerous, bordering the lower ¼ of the leaf. Stem leaves ovate, short- or long-acuminate, costa short or sometimes almost wanting; paraphyllia absent; perichaetium 1.5 mm. long, loosely sheathing, slightly spreading; inner leaves oblong to oblong-spatulate, gradually long-acuminate, serrate above, short-costate, loosely areolate, leaf cells at base rectangular to rhomboidal. Seta about 1 cm. long, rough, twisted to the right; calyptra cucullate, hairy; capsule brown suberect to horizontal, gibbous to slightly curved, with a narrow mouth, slightly constricted under the mouth, and lightly striate when dry and empty, 1.7 mm. long, length 2-3 times the diameter; operculum convex-conic, rostrate; collumella apparently not persistent; annulus of two rows of cells; peristome double;

the teeth linear-lanceolate, united at base, brownish-yellow, closely and regularly articulate, hyaline-margined by the adherent segments. Spores roughened, $25\ \mu$, maturing in autumn.

Type locality, Pennsylvania. On bark of trees and decaying trunks, in woods. Widely distributed throughout the U. S. east of the Mississippi, but not very abundant.

ILLUSTRATIONS: Sulliv. l. c. & Icones *pl.* 90; Hedw. l. c., Suppl. *pl.* 110 (*Pterogonium decumbens*) and *pl.* 243 (*P. ascendens*); M. H. M. 298.

EXSICCATI.—Sulliv. Musc. Allegh. 83 (*Pterigynandrum*); Sulliv. & Lesq. Musc. Bor. Am. Ed. 2, 384; Aust. Musc. Appl. 295; Drummond Musc. Am. (S. States) 88; R. & C. Musc. Am. Sept. Exs. 236; Grout N. Am. Musc. Pl. 108.

The variation in length of leaf is due largely to the variation in the length of the acumination.

HOMALOTHECIELLA FABROFOLIA (Grout) Broth. Engler & Prantl, Musci 1133, Nov. 1908.

Burnettia fabrifolia Grout Bryologist 9: 44. May. 1906.

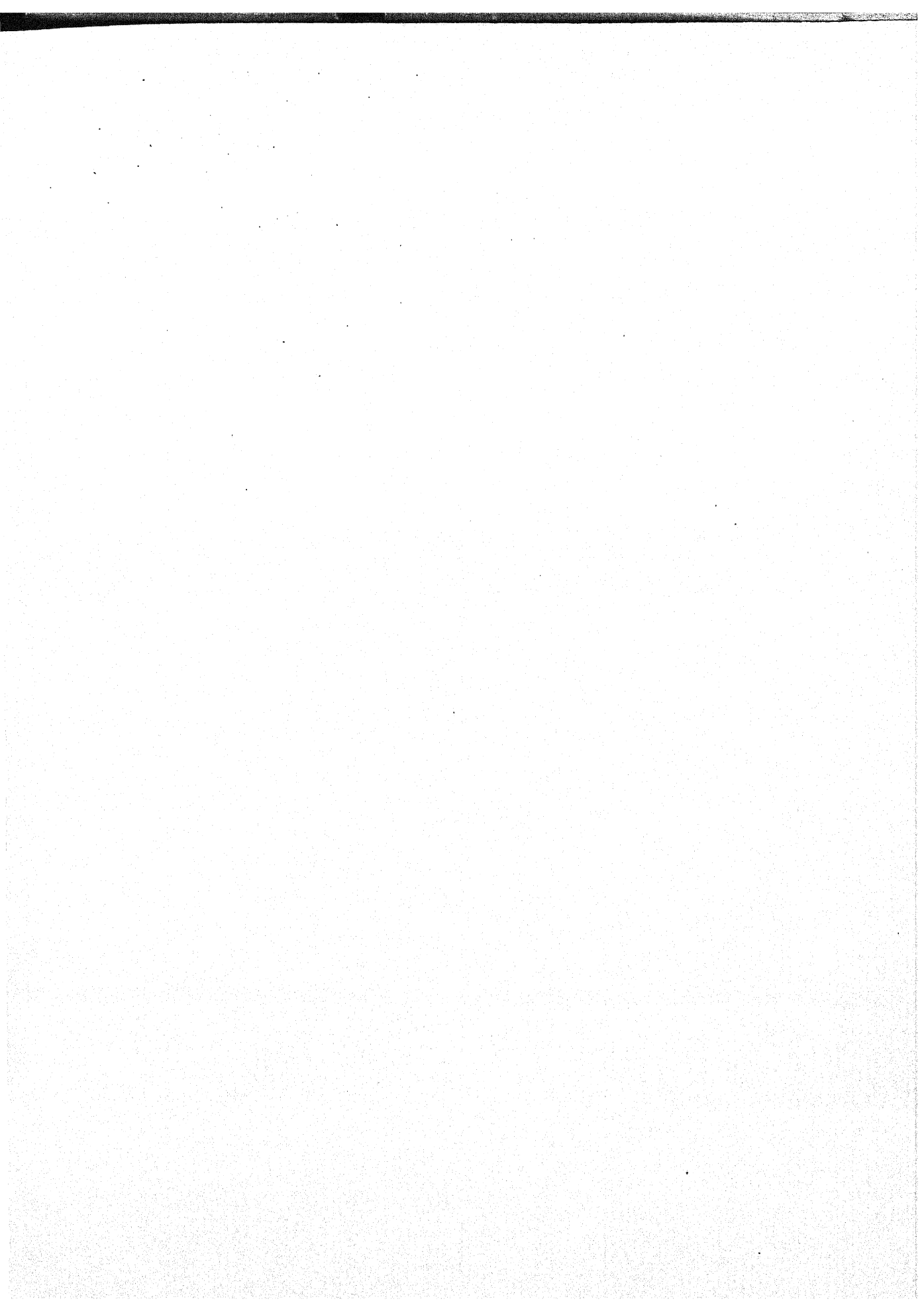
Closely resembling *B. subcapillata*, but with branch leaves broadly lanceolate to ovate-lanceolate, much more gradually narrowed to a longer and more slender acumination; median leaf cells about $\frac{1}{2}$ larger, $60\text{--}80 \times 8\ \mu$, quadrate alar cells fewer and larger, about $16\ \mu$ wide; capsule less gibbous and less plainly narrowed at the mouth. *Pl.* 14.

On bark at roots of trees, near Thomasville, Ga. Coll. by Mrs. A. P. Taylor, Oct. 20, 1905. Type in the herbarium of the author. Co-type in the Herbarium of Columbia University. Sanford, Florida.

The fruiting plants were few and closely intermingled with *Raphidostegium adnatum*. In order that perfect capsules might be left with the type as few peristomes as possible were studied. One of these seemed to have the teeth united at base in pairs. I am greatly indebted to Dr. G. N. Best for assistance in the study of this plant, although he is in no way responsible for this publication. He said that this plant has the capsules of *Homalotheciella*, and the leaves of *Fabronia*. Calyptra not found.

(Plate 2 continued.)

$\times 45$; 7a, apical cells of 9; 8, cells from alar region of 9; 9, branch leaf of *Bestia Breweriana* $\times 34$. The line running from base to margin in 5 and 9 indicates not only the concavity of the leaf but the limits of the area of differentiated alar cells. Figs. 5-9, original drawings by Miss M. E. Vroom. The branch leaves of *Bestia longipes* are often shorter and broader than figured. Fig. 6 was drawn from plants of type collection communicated by Dr. M. A. Howe.



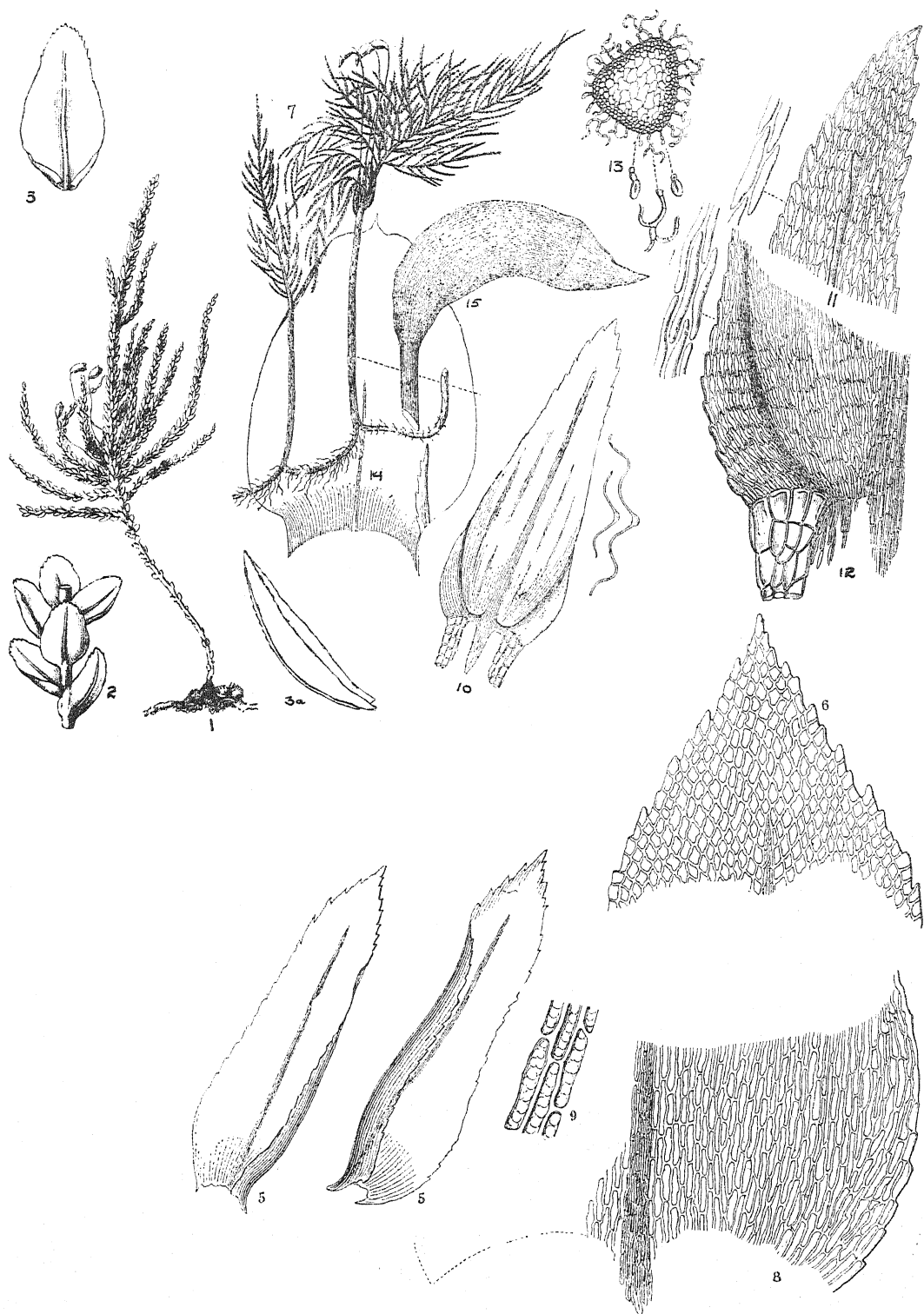


PLATE I. 1-3, *Porotrichum neckeroides*, from Hook. Musc. Exot. 1: pl. 58; 2, portion of branch; 3, branch leaf, 3, a side view of the same.

5-9, *Porotheum Bigelovii* after Sullivant; 3, 5, branch leaves, much enlarged; 6, 8, 9, areolation of the same.

7 and 10-15, *Girgensohnia ruthenica* after Sullivant. 7, plant $\times 1$; 10, branch leaf; 11, 12, areolation of the same; 13, cross-section of stem with paraphyllia; 14, stem leaf; 15, capsule; 10-15 much enlarged.



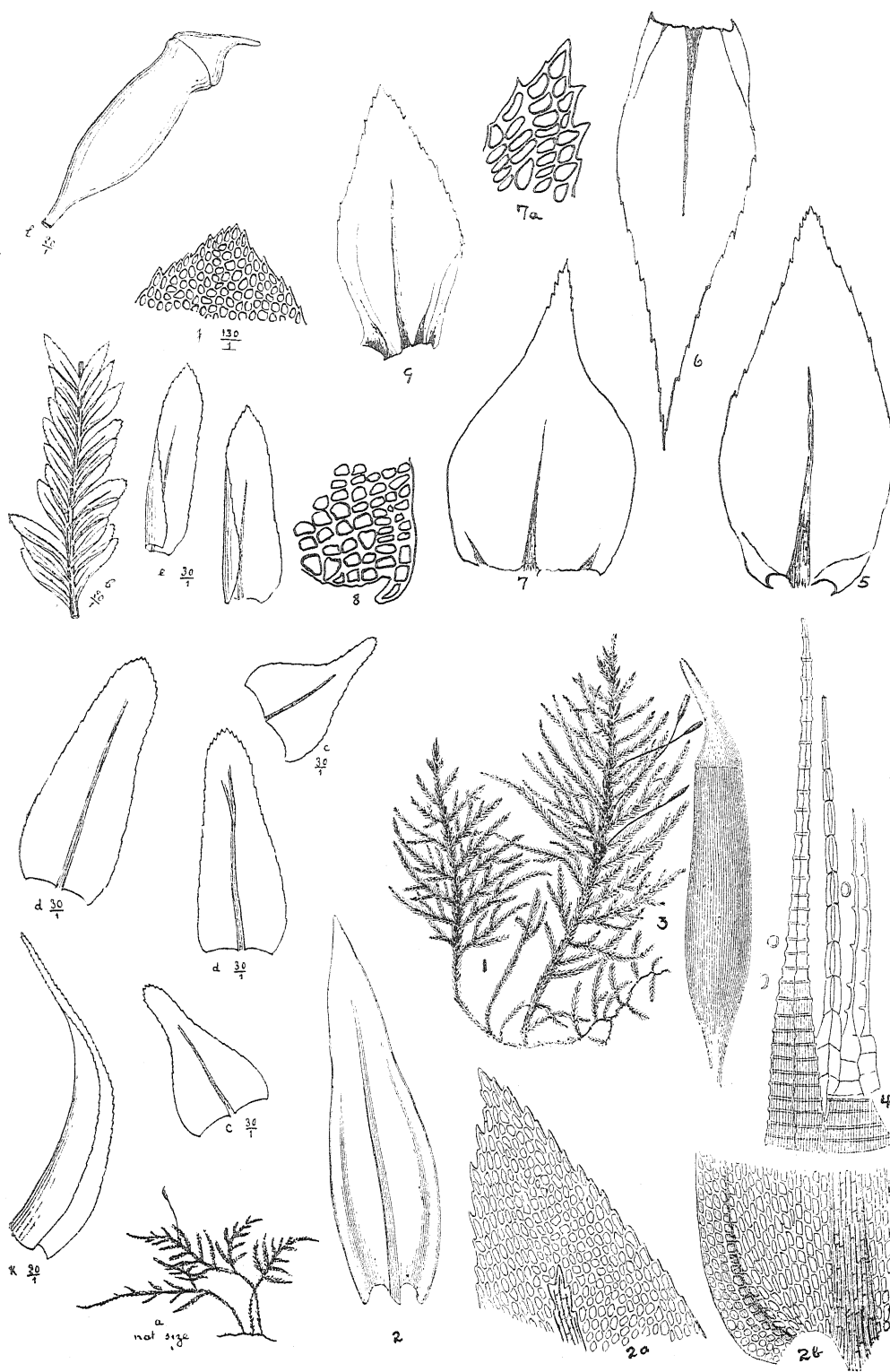




PLATE 3. A, *Pseudisothecium myosuroides* from Bry. Eur. pl. 534; 1 and 2, plants natural size; 3b, stem leaf; 6, 7, 8, branch leaves. The other figures are self-explanatory.

Lower left, figs. 1-6, *P. stoloniferum* from Hooker, Musc. Exot. 1: pl. 74. 1, plant $\times 1$; 2, 2, branch leaves; 4, perichaetial leaf. The other figures are self-explanatory.



PLATE 4. 1-17, *Eurhynchium diversifolium* from Bry. Eur. pl. 520; 1, 2, female plants $\times 1$; 1b, 1 enlarged; 3, male plant; 3b, portion of last magnified; 4, 4a, b, stem leaves, 5-9, branch leaves.
 16-21, *Eurhynchium Rapii*, after Williams; 17, plants $\times 1$; 20, 21, branch leaves $\times 40$; 16, stem leaf $\times 50$; 19, under side of apex of branch leaf $\times 125$; median leaf cells $\times 325$.
 a-c, *Eurhynchium strigosum*, after Cardot; a, stem leaf of the European type; b, b, branch leaves of the same; c, capsule. a**, stem leaf of *E. fallax*; b**, b**, branch leaves of the same.
 a*, stem leaf of *E. fallax Barnesii*; b*, b*, branch leaves of the same; c*, capsule.



Stokesii

PLATE 5. Right half *Eurhynchium oregonum* after Sullivant, all much magnified. 1, portion of branch; 2 and 4, stem leaves; 3, 5, branch leaves; 7, portions of leaf showing cell outlines; 10, 11, 12, paraphyllia; 16, capsule; 18, perichaetium; 25, antheridia with paraphyses.

Left half, *Eurhynchium praelongum Stokesii* from Bry. Eur. pl. 526. 1, female plant; 2, male plant; 3, 4, 5, stem leaves; 7, 8, branch leaves; 9, 10, 11, paraphyllia. The other figures are self-explanatory.



PLATE 6. 1-23, *Cirriphyllum piliferum* from Bry. Eur. pl. 531. 1, plant $\times 1$; 3, 3x, stem leaf; 4, 5, 6, branch leaves from middle, upper, and lower parts of the branch respectively; 3a, 3b areolation of apex and base of leaf; 11, 12, 13, perichaetial leaves. The other figures are self-explanatory.
 1b, 2, and x Branch and leaf of *Cirriphyllum cirrhosum* from Bry. Eur. pl. 530.

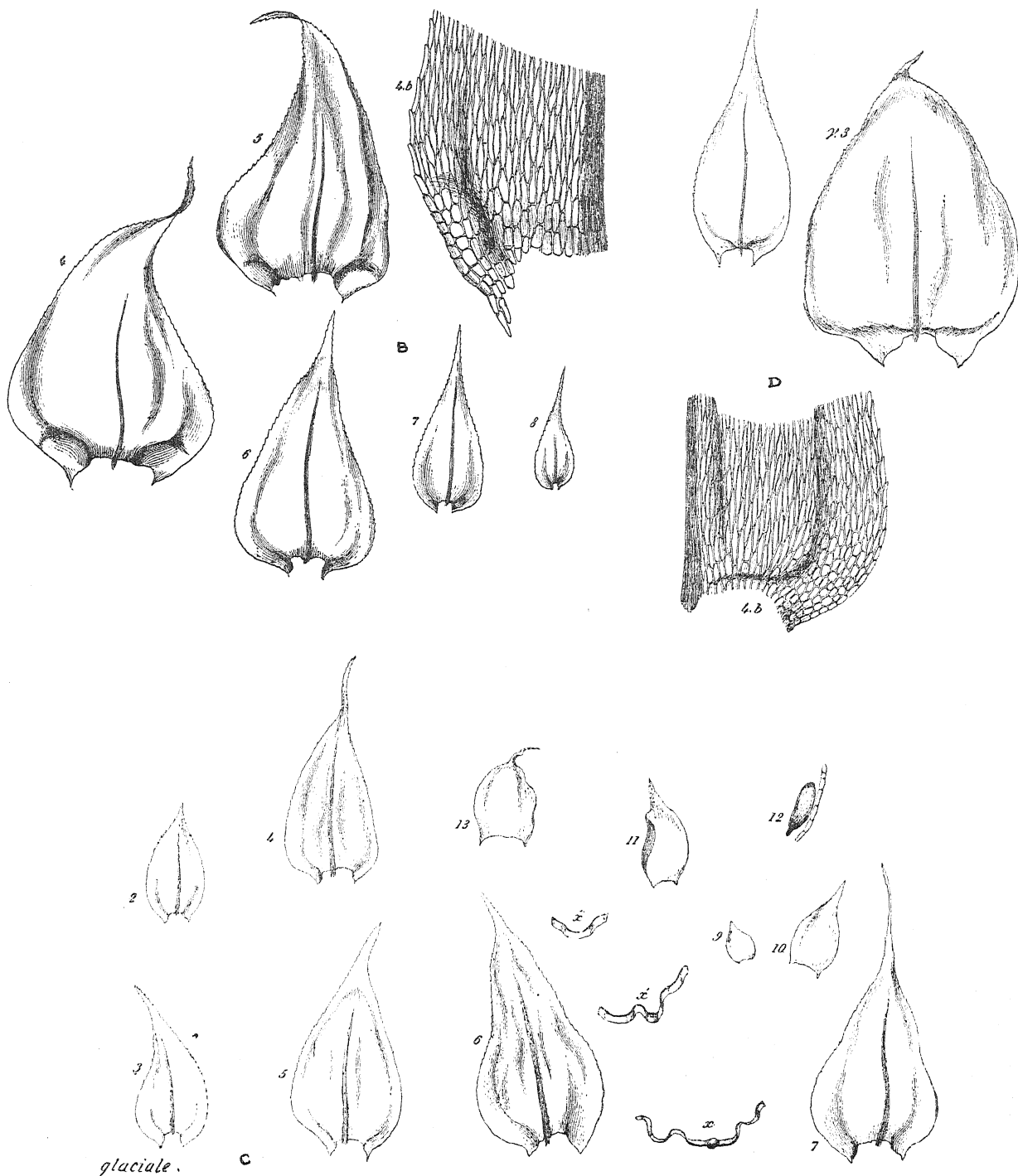


PLATE 7. A, (bottom), *Brachythecium albicans* from Bry. Eur. pl. 553; 4-8, leaves; b, basal areolation; 12-14, perichaetial leaves.

B (left), *B. glareosum*; 6, leaves; 6a, 6b, apex and base of same more highly magnified. The other figures are self-explanatory.

C (right), 12-31, *B. petrophilum*, after Williams; 12, stem leaf; 31, branch leaves; 13, median leaf cells; 16, apical cells; 18, basal and alar cells; 15, capsules.

3a-3e, *B. berinianum* after Theriot; 3a, plant $\times 1$; 3b, stem leaf $\times 26$; 3c, branch leaves $\times 26$; 3d, basal areolation $\times 135$; 3e, median cells.



glaciale.

PLATE 8. C, 4-8, *Brachythecium Starkei* from Bry. Eur. pl. 541; 4-6, stem leaves; 4b, basal and alar areolation of same; 7, 8, branch leaves.

C (bottom), 2-13, *B. glaciale* from Bry. Eur. pl. 542; 4-7, stem leaves; 2, 3, branch leaves; 9-11, perigonal leaves; 12, antheridium and paraphysis; 13, outer perichaetial leaf.

γ^3 . Stem and branch leaf of *B. rutabulum flavescens* from Bry. Eur. pl. 544.

D. 4b, basal and alar areolation of *B. campestre* from Bry. Eur. pl. 545. This is also representative of *B. salebrosum*.

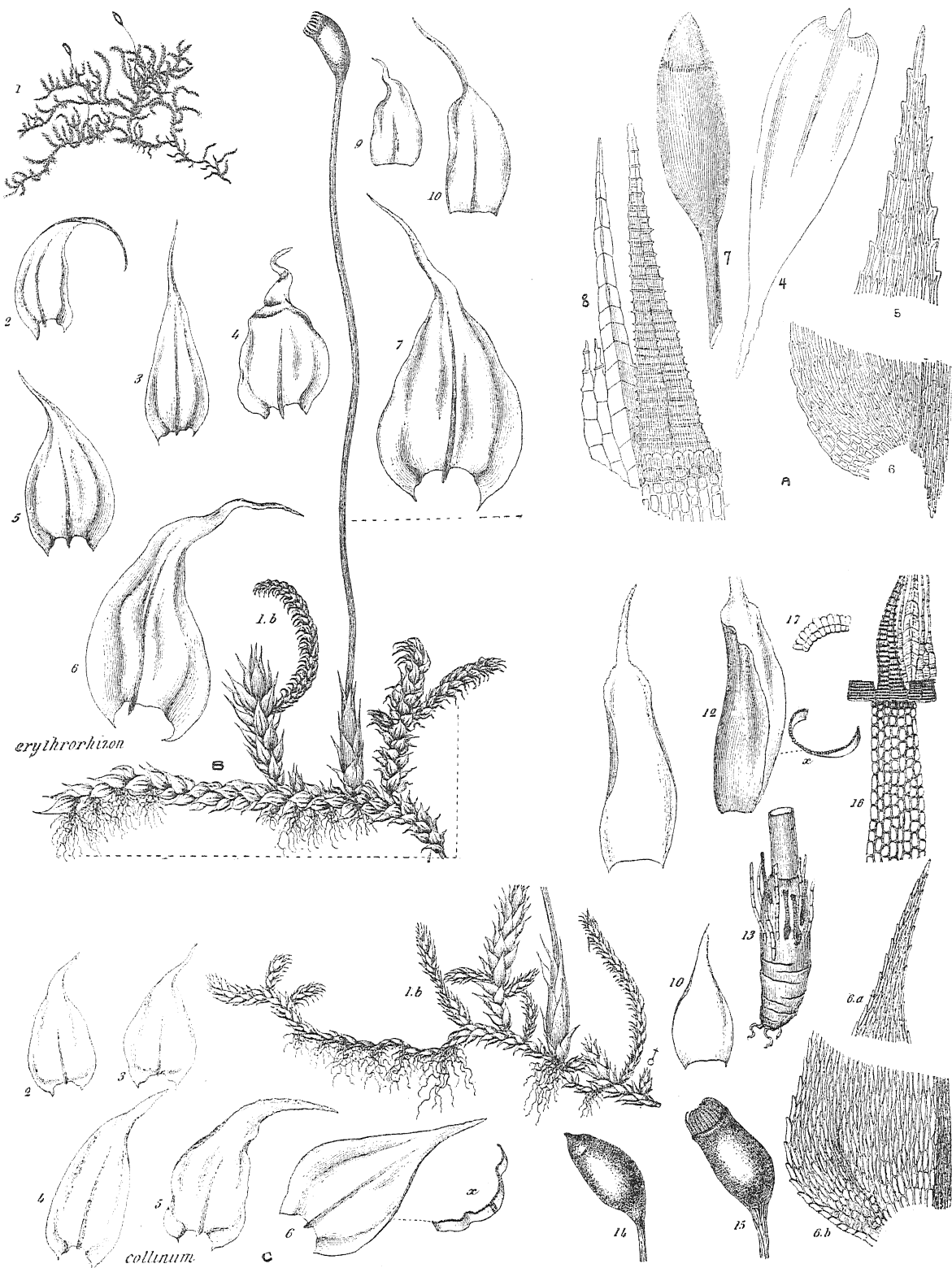


PLATE 9. A, 4-8, *Brachythecium utahense* after Sullivant; 4, stem leaf; 5, 6, apical and basal areolation of same; 7, capsule; 8, peristome.

B, 1-10, *B. erythrorrhizon* from Bry. Eur. pl. 547; 2, 3, branch leaves; 4-7, stem leaves; 9, 10, perichaetial leaves.

C, 1b-17, *B. collinum* from Bry. Eur. pl. 548; 1b, portion of plant enlarged; 2-6, leaves. The other figures are self-explanatory.



PLATE 10. 1-7, *Brachythecium asperum* after Sullivant; 4, 4, branch leaves; 5, stem leaf; 6, basal and apical areolation of 5, much magnified. The other figures are self-explanatory.

c-l, *B. Nelsoni* from the Bryologist; c, capsule $\times 8$; d, e, stem leaves; l and m, basal and median areolation of the same; f, g, h, branch leaves; k, large branch leaf.

1a-f, *B. supaspermum* after Theriot, Bot. Gaz. 37: pl. 24; 1a, entire plant $\times 1$; 1b, branch leaf; 1b', stem leaf; 1d, 1e, basal and median areolation; 1e' cross section of seta; 1f, capsule.

8-12, *B. washingtonianum* from the Bryologist; 8, plant $\times 1$; 9, capsule; 10, stem leaf; 12, alar cells of the same; 11, branch leaf.

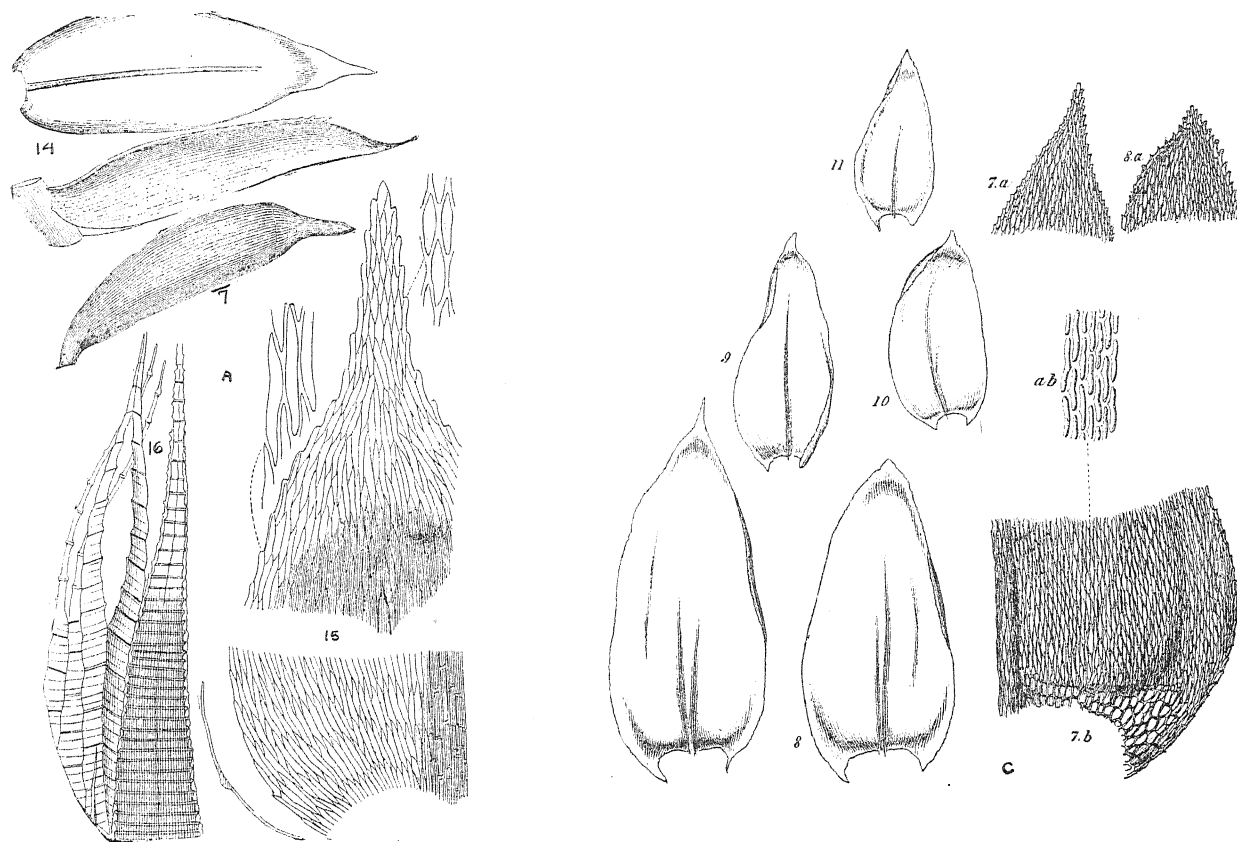


PLATE II. A, 7-16, *Scleropodium colpophyllum* after Sullivant; 14, branch leaves; 15, apical and basal areolation of the same; 7, capsule; 16, peristome.
 B, (bottom) 1b-13, *S. caespitosum* from Bry. Eur. pl. 556; 1b, portion of plant enlarged; 3, 4, stem leaves; 4b, 4a, basal and apical areolation of the same with a few enlarged median cells at right of 4b; 7a, apex of branch leaf; 12-13, perigonal leaves.
 C (upper right), *S. illecebrum*, leaves and areolation.

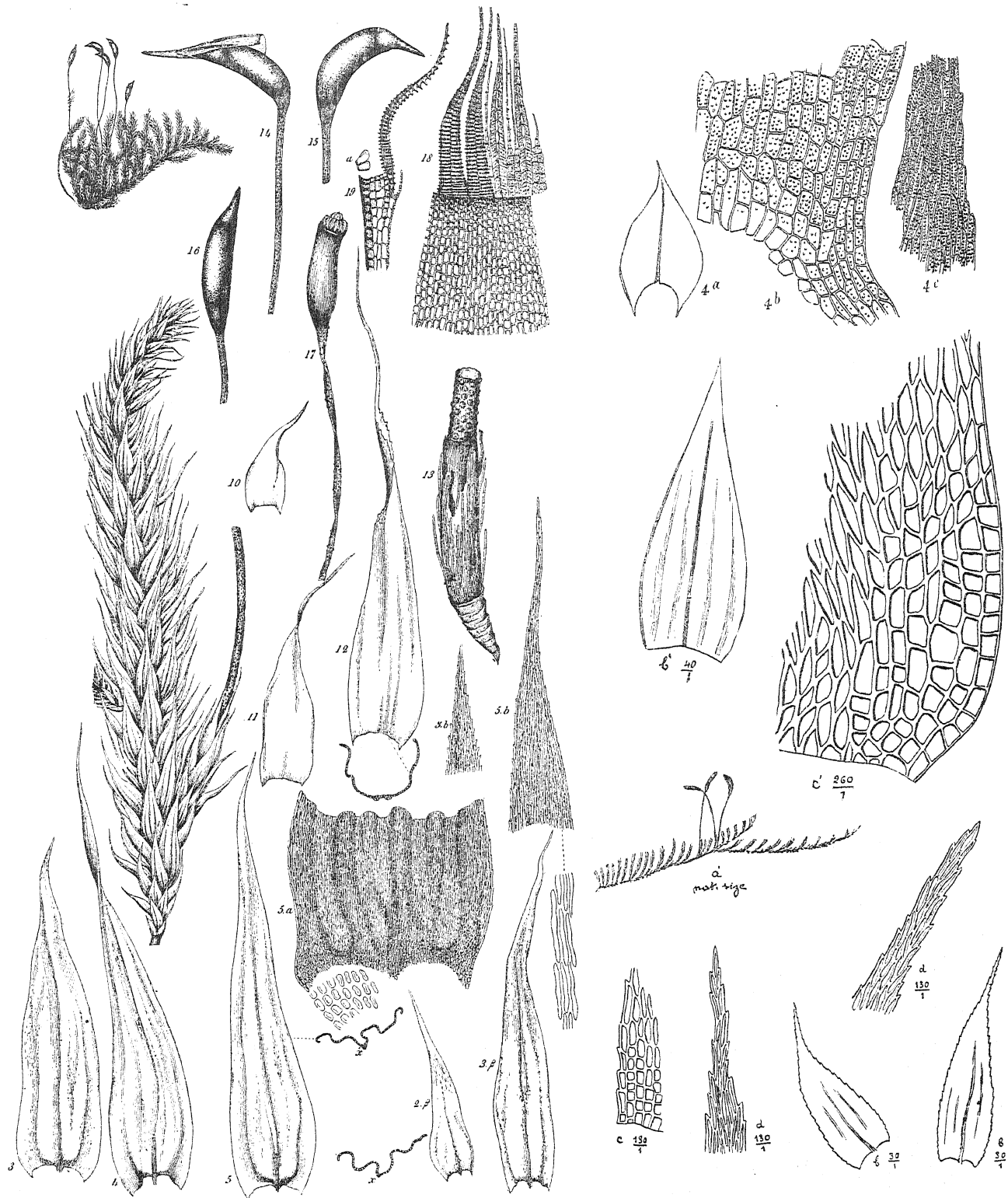


PLATE 12. Left half, *Camptothecium lutescens* from Bry. Eur. pl. 558; 3, branch leaf; 3b, apex of same; 4, 5, stem leaves; 5a, 5b, base and apex same; 11, 12, perichaetial leaves. The other figures are self-explanatory.

Right half, 4a, 4b, 4c, leaf, alar and median leaf cells of *Brachythecium Bestii* after Theriot. 4a', b', c', plant, lower branch leaf and basal cells of *Camptothecium Amesiae* after Cardot. The upper branch leaves are less acute as in *C. aeneum*. See Pl. 14.

b, b, leaves of *Brachythecium erythrorrhizon suberythrorrhizon*; c, basal areolation of same; d, d, apical cells.

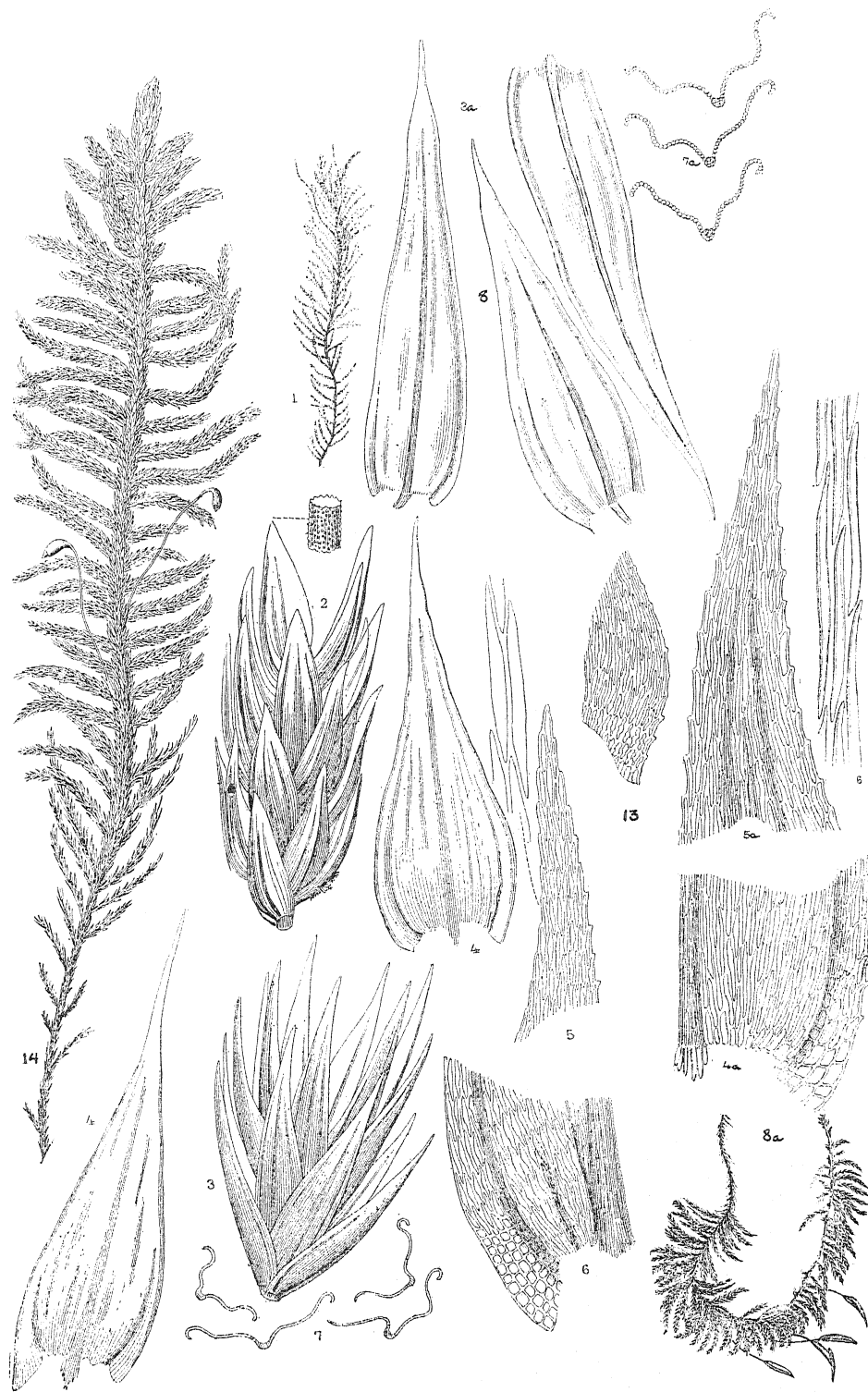


PLATE 13. 1, 3-7, *Camptothecium pinatifidum*, after Sullivan; 1, plant $\times 1$; 3, portion of branch; 4, 4, stem and branch leaves; 5 and 6, apical and basal areolation of the same; 7, cross-sections of leaves. 14, Plant of *C. megaptitum* $\times 1$; 2, portion of branch and of seta of same; 13, alar cells of same. The other figures are of *Homalothecium Nuttallii*; 8a, plant $\times 1$; 8, leaves; 7a, cross sections of same; 4a, 5a, basal and apical areolation; beside 5a are magnified median cells numbered 6 by mistake.

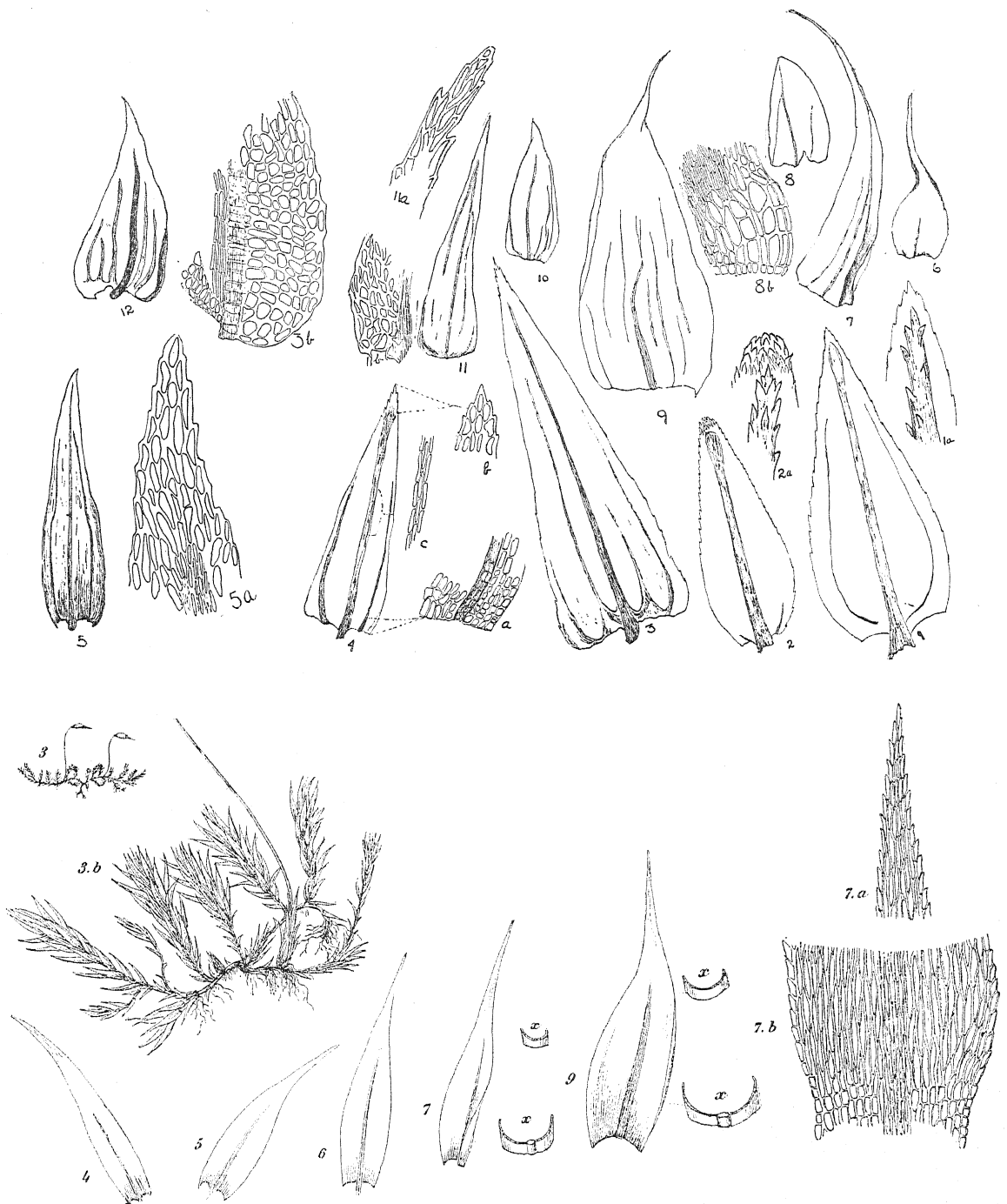


PLATE 14. 1, stem leaf of *Camptothecium alsoides* $\times 50$; 1a, back of costa much more magnified; 2, branch leaf of *C. alsoides* $\times 50$; 2a, back of costa of same much more highly magnified (1 and 2 from type collection); 3, stem leaf of *C. arenarium* $\times 35$; 3b, alar cells of same; 4, branch leaf of *C. Nevadaense* with basal, median and apical areolation; 5, branch leaf of *C. aeneum* $\times 33$, from the type; 5a, apical cells of same; 6, leaf of *Homalotheciella fabrofolia* $\times 12$; 7, stem leaf of *C. paulianum* $\times 12$, from the type; 8, lower branch leaf of *Scleropodium obtusifolium* $\times 12$; 8b, alar cells of same $\times 100$; 9, stem leaf of *C. megaptilum Fosteri* $\times 12$; 10, small branch leaf of the same $\times 12$; 11, leaf of *Homalothecium Bonplandii* $\times 12$; 11a and 11b, apical and basal cells of 11; 12, stem leaf of *Brachythecium lamprochryseum* from Mt. Finlayson $\times 12$.

Figures 1, 2, 3, 4, 5, and 12 by Miss M. E. Vroom. 6, 7, 8, 9, 10, and 11, camera lucida drawings by Miss Marjorie Eddy.

Lower portion, *Rhynchostegiella curviseta* from Bry. Eur. pl. 509; 3, plant $\times 1$. The other figures are self explanatory.